ENERGY MANAGEMENT SOFTWARE

POWERSTUDIO SCADA

Version 2.7

USER MANUAL

(M98227501-03-09A)

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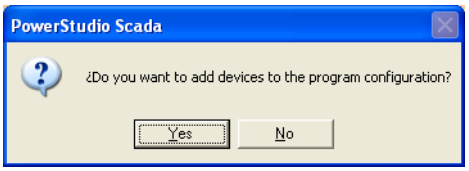
1 Running the Programme for the First Time

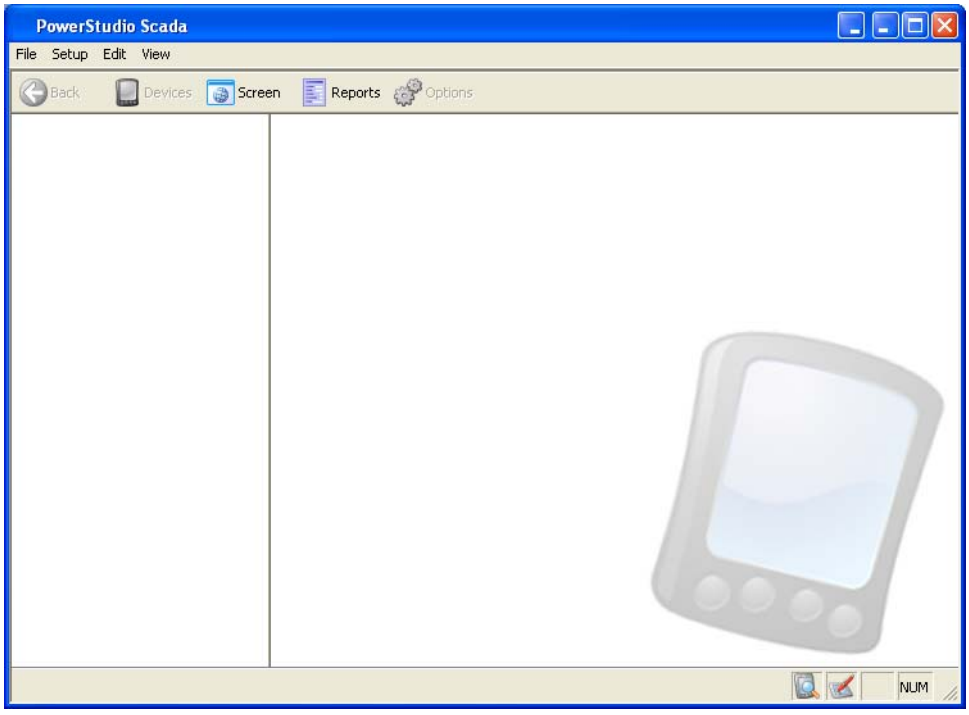
When running for the first time the program will ask if you want to add devices.



Selecting '*Yes*', will allow us to add devices as will be explained later in section 2.2.2.1 Adding a First level Device.

When the device is added, you will be asked if you want to add any more devices.

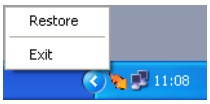
If '*Yes*' is chosen then a new device will be added, otherwise, normal running of the programme will start.



It can be seen that the program consists of four distinct areas:

The main menu: Situated at the top and gives access to all the functions of the programme.
Button bar: Placed just below the main menu and gives fast access to the most frequently used functions.
Status bar: Situated at the bottom it offers general information on the status of the application.
Main view: Occupies the rest of the available space and contains the current active view.

N.b: While this is the general view of the software, once it has been configured and the installation is running, it can and should be minimised using the button to the left of the four buttons on the top right-hand corner of the window. The programme will then only be shown as an icon in the shape of a small orange arrow on the right hand side of the toolbar (where the time and other programmes such as the anti-virus etc. can normally be found which run in the background on the machine).



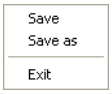
Thus avoiding the bother of having it permanently visible on screen, while at the same time avoiding that it is accidently closed or that other machine users are tempted to use it.

To return to Power Studio again, normally it is enough just to double click on the icon and select “*Restore*” from the contextual menu which appears when clicking on the right-hand mouse button.

As you can see, when the right-hand mouse button is clicked, as well as the "*Restore*” option the “*Exit*” option is also available. Use this option to leave the programme outright.

2 Menu Bar

2.1 File Menu

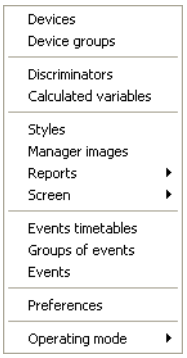


'Save': This option can only be used when editing a SCADA screen or a report, otherwise it remains disabled. It enables changes to be made to the SCADA screen or a report while it is being edited.

'Save as': Offers the same characteristics and the same function as the *Save* option, except that this allows changes to be saved on another SCADA screen or a different report to that being edited.

'Exit': This brings the running of the programme to a finish.

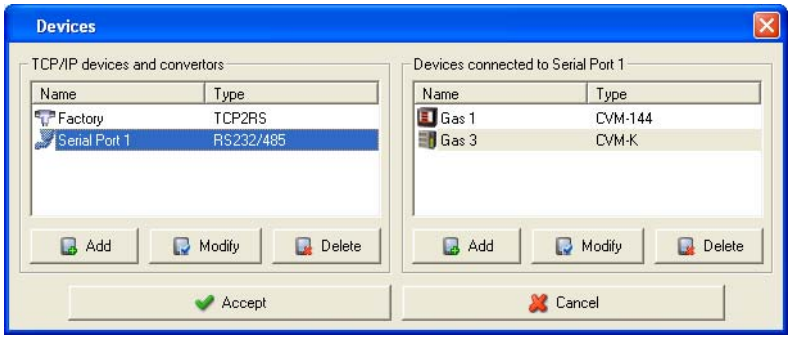
2.2 Set up menu



The main software parameters can be configured using this menu.

2.2.1 Devices

Clicking on this option will bring up the following dialogue:



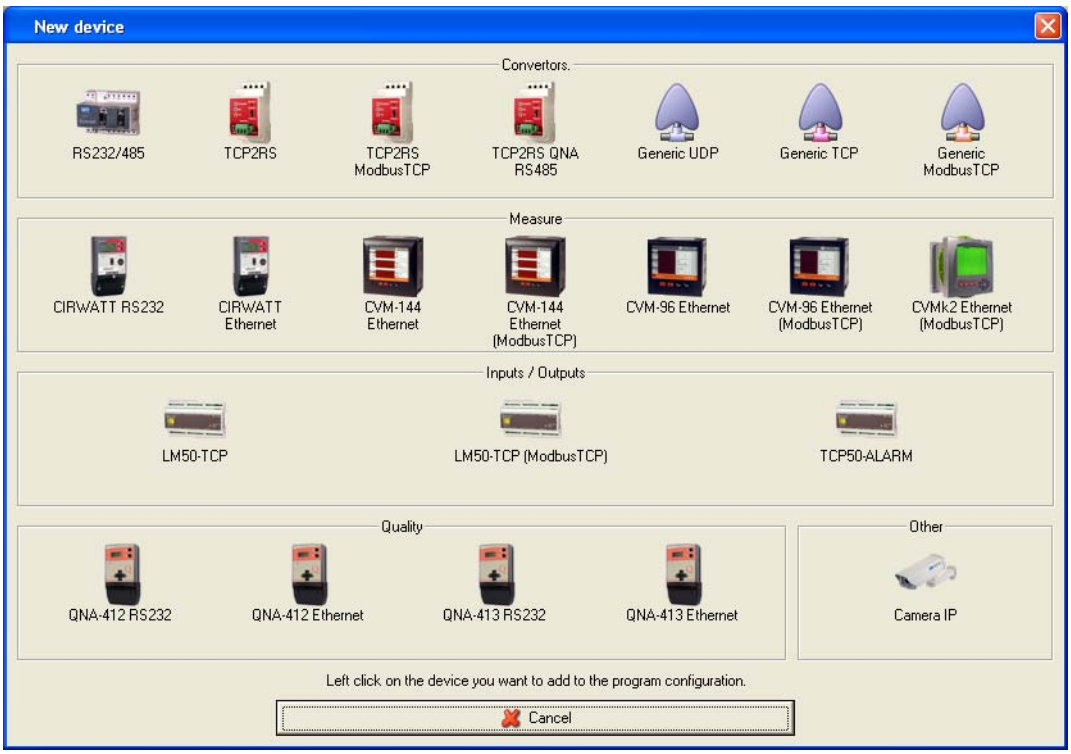
Here a list with configured devices can be seen, distributed just as they are physically connected.

On clicking the *'Accept'* button the software will try to configure, on those converters and devices that can be configured, the communication speeds configured in the corresponding advanced configuration window, see section 2.2.1.3 Advanced Configuration of Devices.

Devices have been classified into those which have a direct connection and converters and those devices which must be connected to others so that the software can connect with them. The

former appear on the list at the left of the dialogue, and will be called first-level devices from now on, the second type can be found on the right, and from now on will be termed second-level devices.

Clicking the '*Add*' button to left of the dialogue; the following dialogue will appear:

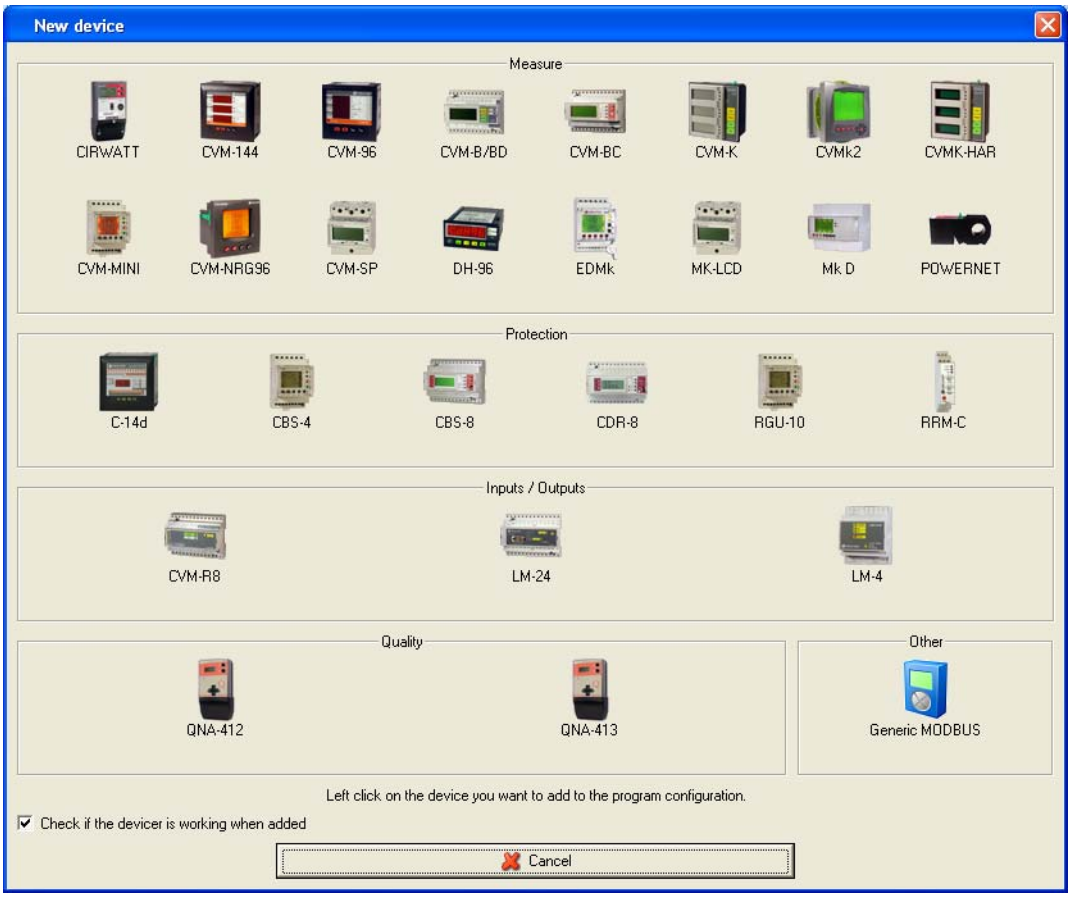


From here the device we wish to add can be selected. As has been previously mentioned, in this dialogue only direct connection devices appear, either with a network connection or with an RS232 connection directly to the PC, and communication converters.

Bear in mind that if any of the first-level devices are deleted, second-level devices connected to them will also be deleted.

Once the first-level device has been selected, the devices connected to it may be added by clicking on the '*Add*' button to the right of the dialogue.

In this case only those devices which can be connected to a first-level device appear in the dialogue selection.



The option *'Check if the device works when added'* indicates to the software that when added, the connection should be verified and will give the error message if the device is not working correctly or is absent. If when adding a device this check is not required, either because it has not been installed yet or for any other reason, this option should be deselected.

It is possible that while devices are being added or altered, communication with such devices may not be possible if the configured speed is different to the connection speed, but communication will be possible once the software finalises the speed configuration process.

Below is a table showing the possible combinations between different devices, with first-level devices shown in the columns and the possible second-level devices that can be connected to them in the rows.

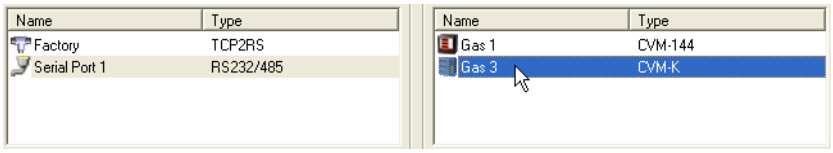
	RS232/485	TCP2RS	TCP2RS Modbus TCP	TCP2RS QNA RS485	LM50-TCP	LM50-TCP Modbus TCP	TCP50-Alarm	Generic UDP [3]	Generic TCP [3]	Generis ModubsTCP [3]
C-14d	X	X	X				X	X	X	X
CBS-4	X	X	X		X	X	X	X	X	X
CBS-8	X	X	X		X	X	X	X	X	X
CDR-8	X	X	X		X	X	X	X	X	X
CIRWATT	X	X	X[1]		X	X[1]	X[1]	X	X	X[1]
CVM-144	X	X	X		X	X	X	X	X	X
CVM-96	X	X	X		X	X	X	X	X	X
CVM-B/BD	X	X	X[2]		X	X[2]	X[2]	X	X	X[2]
CVM-BC	X	X	X		X	X	X	X	X	X
CVM-K	X	X	X[2]		X	X[2]	X[2]	X	X	X[2]
CVM-K2	X	X	X		X	X	X	X	X	X
CVM-K HAR	X	X	X[2]		X	X[2]	X[2]	X	X	X[2]
CVM-MINI	X	X	X		X	X	X	X	X	X

	RS232/485	TCP2RS	TCP2RS Modbus TCP	TCP2RS QNA RS485	LM50-TCP	LM50-TCP Modbus TCP	TCP50-Alarm	Generic UDP [3]	Generic TCP [3]	Generis ModubsTCP [3]
CVM-NRG96	X	X	X		X	X	X	X	X	X
CVM-R8	X	X						X	X	
CVM-SP	X	X	X		X	X	X	X	X	X
DH-96	X	X	X		X	X	X	X	X	X
EDMk	X	X	X		X	X	X	X	X	X
Generic MODBUS	X	X	X		X	X	X	X	X	X
LM-24	X	X	X				X	X	X	X
LM-4	X	X	X		X	X	X	X	X	X
MK-LCD	X	X	X				X	X	X	X
Mk D	X	X	X		X	X	X	X	X	X
POWERNET	X	X	X		X	X	X	X	X	X
QNA-412	X			X				X	X	
QNA-413	X			X				X	X	
RGU-10	X	X	X		X	X	X	X	X	X
RRM-C	X	X	X		X	X	X	X	X	X

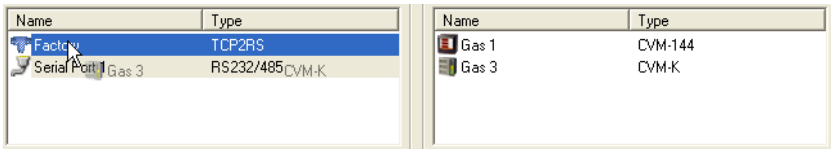
[1] Downloading data using IEC 870-5-102 is not recommended when the communication protocol is Modbus TCP.
[2] Restricted to reading values. Configuration is not possible.
[3] Depending on the generic converter used, communication errors may be produced with other devices. To learn how to configure the generic converters see the corresponding manual.

It is possible to move the second-level devices to a first-level device different to that previously added by following these steps:

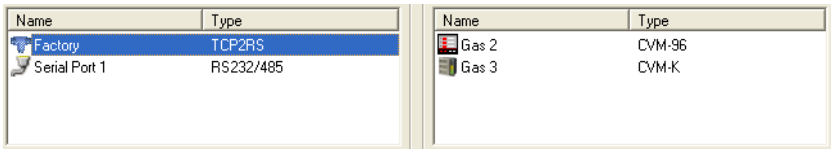
Select devices to be moved by clicking the left mouse button.



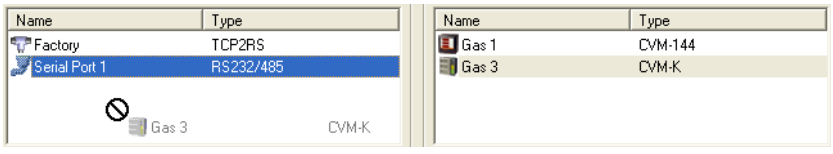
Without releasing the left mouse button, drag the cursor to the first level device to where we want to move the selected devices



Finally, release the left mouse button for the change to take place

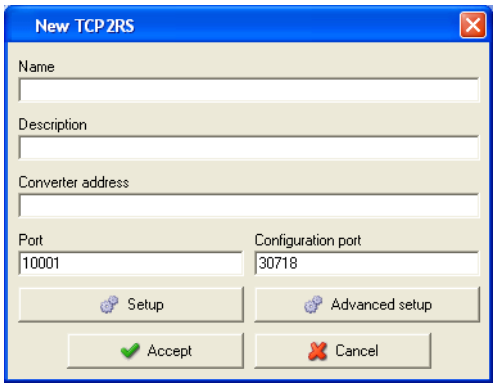


If it is not possible to move the device to the desired first-level device, either because communication is not permitted or second-level devices can not be connected or there is an inconsistency between devices, the cursor will change to, to signal that the operation is not permitted



2.2.1.1 Adding a First-level Device

Depending on the type of device you want to add, the device screen can vary. The typical first-level device configuration screen is displayed below, however depending on the device you want to add some parameters do not exist or specific parameters for the device should be configured. The special parameters for each first-level device will be dealt with in detail in the section dealing with the device.



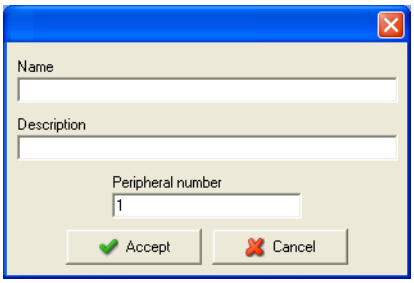
In which:

- **Name:** Alphanumeric field which uniquely identifies the device throughout the program. There are no two devices in the configuration with the same name.
- **Description:** Alphanumeric type data to enter a brief description of the device.
- **Converter address:** Corresponds to the address through which the program can communicate with the device. This parameter can be an IP address or a name. This address should not be confused with the MAC address.
- **Port:** Corresponds to the communication port.
- **Configuration port:** Corresponds to the communication port that the program uses to configure communications on the devices.
- **Parameters:** General communication parameters configuration.
- **Advanced Configuration:** See 2.2.1.3 Advanced configuration of devices.

Depending on the device added there may be more or fewer parameters. For more information see the section on the corresponding device.

2.2.1.2 Adding a Second-level Device

The configuration of second-level devices will be easier as communication configuration is not required. Second-level devices communicate with the programme through the first-level devices they are connected to.

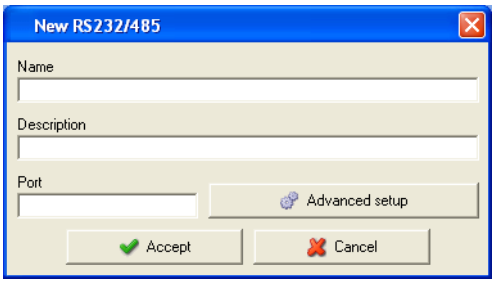


In which

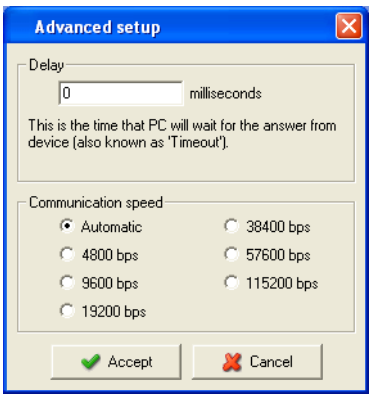
- **Name:** Alphanumeric field which uniquely identifies the device throughout the program. There are no two devices in the configuration with the same name.
- **Description:** Alphanumeric type data to enter a brief description of the device.
- **Peripheral Number:** Number identifying the device in communications. Two second-level devices connected to the same first-level device may not have the same peripheral number.

2.2.1.3 Advanced Configuration of Devices

On devices with direct connection features, such as converters, the configuration of certain communication aspects will be possible. Below is the configuration dialogue of device RS232/485 showing the button from where we can configure these parameters.



Clicking on the *'Advanced setup"* button enables the configuration of these additional parameters.



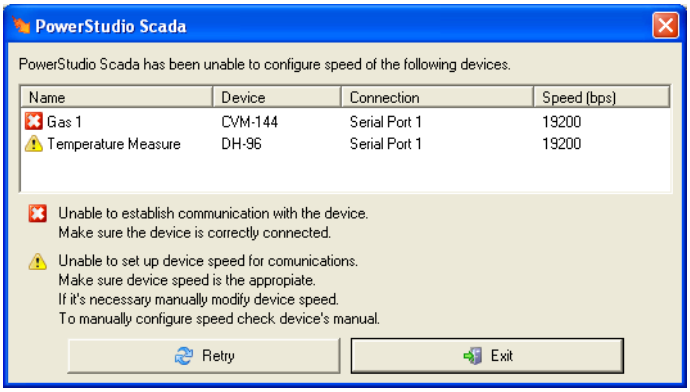
Depending on the device being configured, some of these parameters may not appear.

- **Delay:** Value in milliseconds. This value known as “Timeout” is used to control the time that software will await the response from a device. The value entered will be added to the default waiting time for a response from the device.

- **Speed of Communication:** Allows communication speed between the software and the device to be selected. This speed is automatically assigned by default, but it may also be forced to the desired speed. If configured as automatic, this means that the software will try to configure the devices at a maximum speed common to them all. If on the contrary a specific speed were selected, the software will configure the devices at this speed, and what may occur is that devices unable to communicate at that speed no longer communicate.

Speeds are configured to accept changes in the device screen. See section 2.2.1 Devices.

Once speeds are configured, if there have been any problems the following dialogue will appear.



Here the different devices are shown whose speeds have been unable to be configured. There are two types of warnings

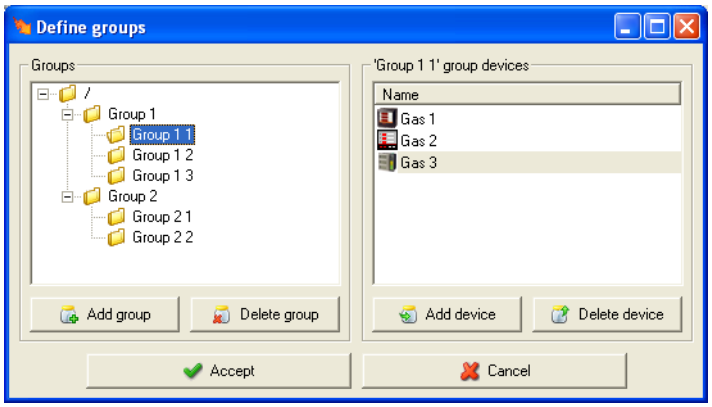
When there have been errors in communication with the device. Once the problems have been resolved speed configuration can be attempted once more by clicking the button ‘*Re-try*’.

When the characteristics of the device make it impossible to change the speed by communication.

The user is responsible for manually configuring the suitable speed on those devices where it is not possible to configure the speed by communication. To learn how to change the speeds on the devices, consult the corresponding manual.

2.2.2 Groups of Devices

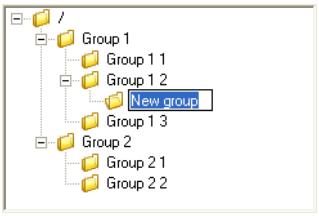
Using this option, devices can be grouped together. It is possible to have the same device in different groups; similarly groups can also be grouped.



The left part of the dialogue corresponds to the defined groups. The tree structure (with son and father nodes) will facilitate the display of the dependency between groups.

/ This is the root group of the tree. When new devices are added, these are added automatically to this root group.

Add group Clicking will add the group as son of the selected group (father). Only the name of the group must be entered in the new group created.

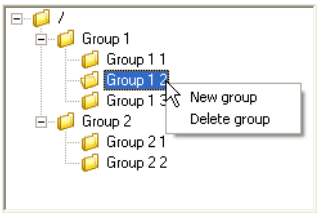


If we then want to change the name of a group at a later stage, select the group and then click on the name with the left mouse button.

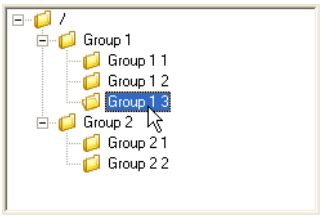
Within the same father group the names of the son groups cannot be repeated, but it is possible to repeat the names of the groups in father groups.

Delete group Clicking will delete the selected group, as well as all the son groups. It will be possible to delete any group except '/; (root group).

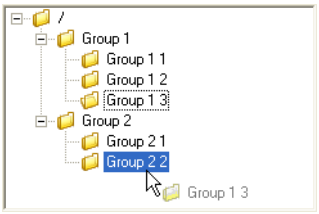
It is also possible to add or delete groups clicking the right button of the mouse on the node you want to add a son node or on the node you want to delete. Clicking will bring up the corresponding menu to select the desired action.



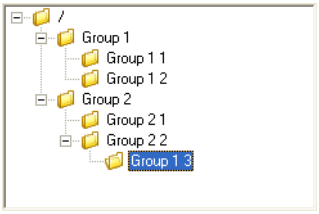
Lastly, it will be possible to move or copy a group. For this click the left mouse button on the group you want to move or copy.



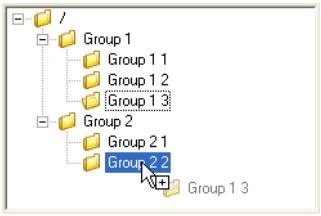
Without releasing the mouse button, drag the group to the destination father group.



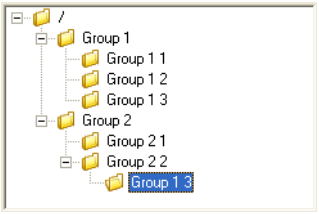
If you want to move the group, just release the left mouse button for the change to take place.



If on the contrary you want to make a copy of the group, click the CTRL button and without releasing the left mouse button, the cursor will change to , indicating that a copy will be made of the group.



Finally, release the left mouse button of the mouse to make a copy of the group.



If you try to drag a group which is not possible to copy or move, the cursor will change to , to indicate that the action is not permitted.

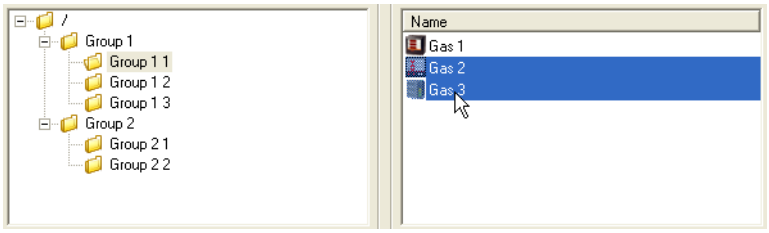
The right part of the dialogue is formed by the device list that belongs to the group selected from the tree.

For easier identification the name of the group is indicated in the list description: 'Group 1 1' group devices.

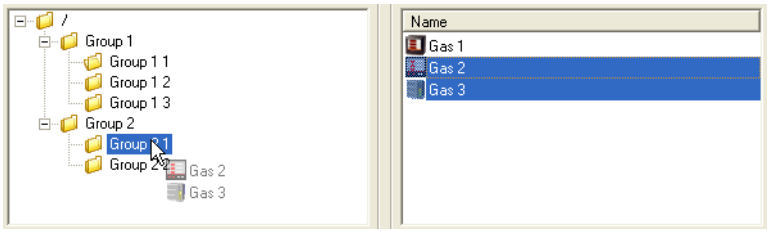
Clicking the button will bring up the following dialogue box:

Here a list of configured devices which do not belong to the group will appear. Click on the "*Accept*" button and the devices selected from the list will be added to the group.

Likewise, once the devices have been added to a group it will be possible to change them easily to another group or copy them by selecting them and then clicking the left mouse button when on the selected devices.



Without releasing the left mouse button, drag to the target group.



Finally, release the left mouse button for the change to take place.

If you want to copy the devices to another group, proceed in the same manner as with the copy of groups, clicking the CTRL key before releasing the left mouse button.

This will only be active if there are devices selected from the device list. On clicking the button the devices selected will be deleted from the corresponding group.

2.2.3 Discriminators

Enables discriminators to be added, modified or deleted.

The configuration of discriminators will be explained at length in chapter 5 of this manual, Discriminators.

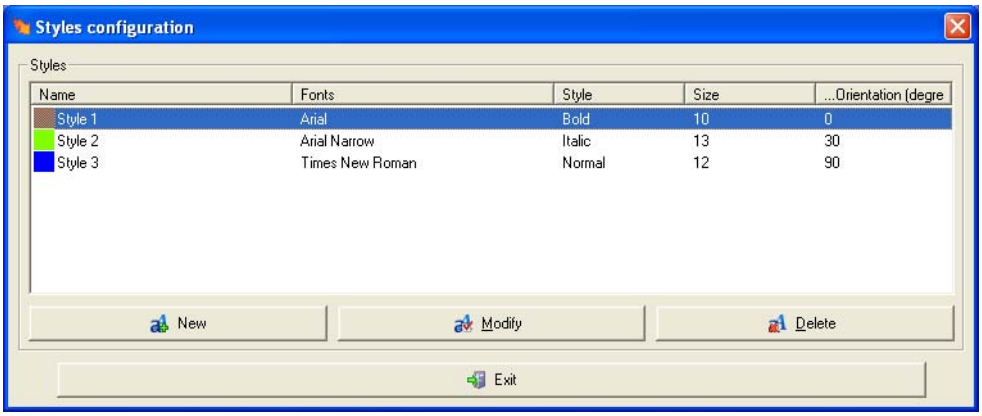
2.2.4 Calculated variables

Enables variables, to be calculated, changed or deleted.

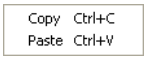
The configuration of calculated variables will be explained at length in chapter 6 Calculated Variables.

2.2.5 Styles

This option can be used to add, modify or delete font styles used to show the values on the different SCADA screens and reports. Each one of the styles will be made up of a colour and a font format.

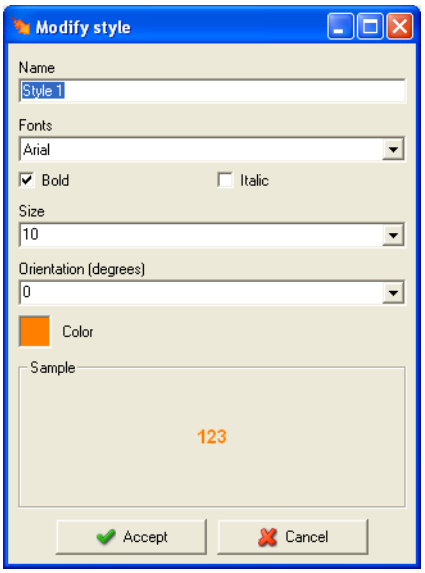


Clicking the right button on the mouse over the list of styles the following contextual message will appear.



This will enable styles to be pasted and copied. It may be possible that some of the options from the context menu do not appear, copy will only appear if there is a style selected and the paste option only if the styles have been copied onto the clipboard. If no style is selected or there are no styles on the clipboard, when the right button is pushed the context menu will not appear.

Push the '*New*' or '*Modify*' button and it will be possible to add or modify a style.



Corresponds to the name of the style. This name will uniquely identify the style; there are no two styles with the same name.

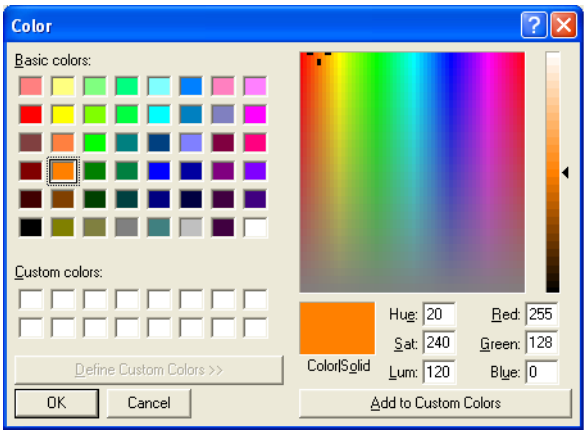
Will correspond to the type of font used for the style.

Corresponds to the style of the font. Depending on the font selected, you can choose bold and / or italics.

Corresponds to the size of the font. The size can be between 1 and 90. The size can be either keyed in or selected from the dropdown menu which shows the options available.

Corresponds to the orientation of the text. The orientation (expressed in degrees) can be between 0 and 350. The size can be either keyed in or selected from the dropdown menu which shows the options available.

Clicking on the button the style colour can be selected.

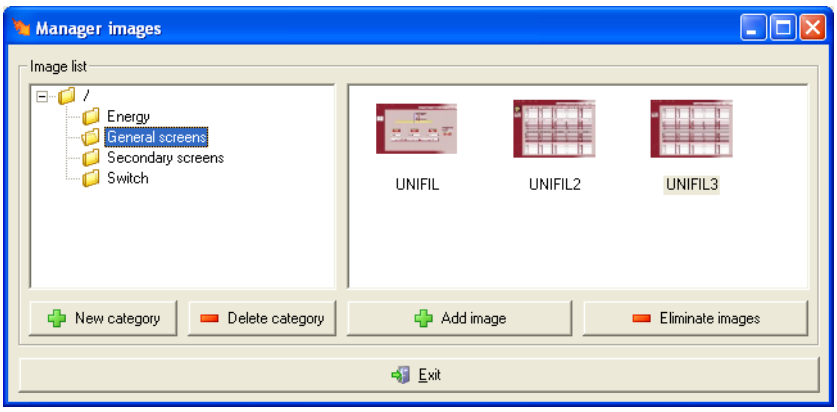


Shows an example of how the style will appear.

The ‘*Delete*’ button will only be active if there are styles selected from the style list. Clicking the button will delete the styles selected.

2.2.6 Image manager

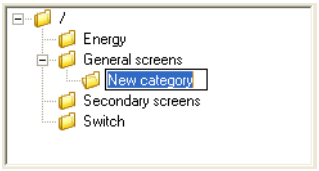
Using this option images used to create a SCADA screen or a report can be added, modified or deleted. The organization of the images is in the form of a tree so it can be classified into three different categories to be chosen by the user.



The left side of the dialogue corresponds to the categories defined. The representation in tree form (with son and father nodes) will facilitate the display of the dependency between categories.

/ This will be the root group of the tree. When adding new images, they are automatically added to this root group.

New category On clicking this, the group will be added as son to the selected group (father). Then the name of the group is entered into the new node created.

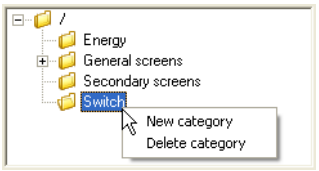


If you then want to change the name of a group, select the group and once selected click on the name with the left mouse button.

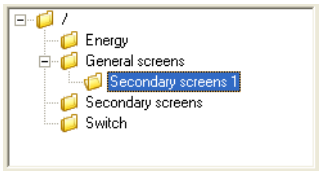
Within the same father group the names of the sons cannot be repeated, but it is possible to repeat the names of groups in different father groups.

Delete category Clicking this deletes the group selected, as well as all the sons' categories. It will be possible to delete any group except the / (root group).

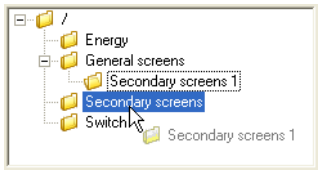
It will also be possible to add or remove categories clicking the right mouse button on the group you want to add a son group or on the group you want to delete. The menu corresponding to the selection of the desired action will appear.



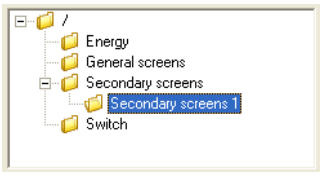
Lastly, it will be possible to move or copy a particular group. For this you must click on the left mouse button over the group you want to move or copy.



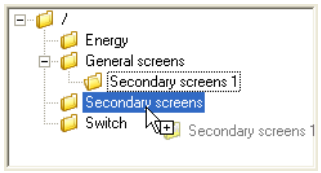
Without releasing the mouse button, drag to the destination group.



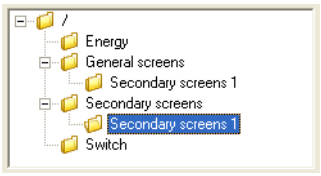
If you only want to move the group you should release the left mouse button for the change to take place.



If on the contrary you want to make a copy of the group, Click the CTRL button and without releasing the left mouse button, the cursor will change to ; indicating that a copy will take place of the group.

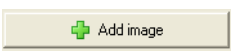


Finally, release the left mouse button to make a copy of the group.



If you want to drag a group where it is not possible to copy or move it, the cursor will change to ; to indicate that the action is not permitted.

The right side of the dialogue is formed by a list of images which belong to the group selected from the tree.



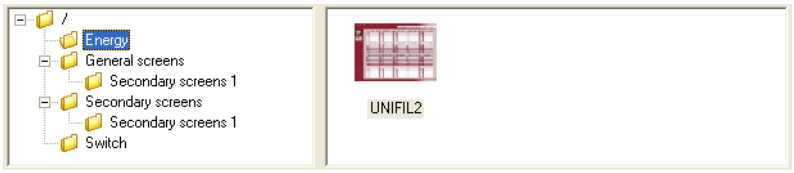
Clicking here will bring up a dialogue that allows you to select an image stored on the PC for later use in SCADA screens or reports. PowerStudio will create a copy of the image and will work with the copy, at no time will PowerStudio use the original image selected.

The images that can be added should have a maximum size of 2 Mbytes and a maximum resolution of 2048x2048 pixels.

Likewise, once images have been added to a group they can be easily copied or changed, by clicking the left mouse button on one of those selected.

Without releasing the left mouse button, drag to the destination group.

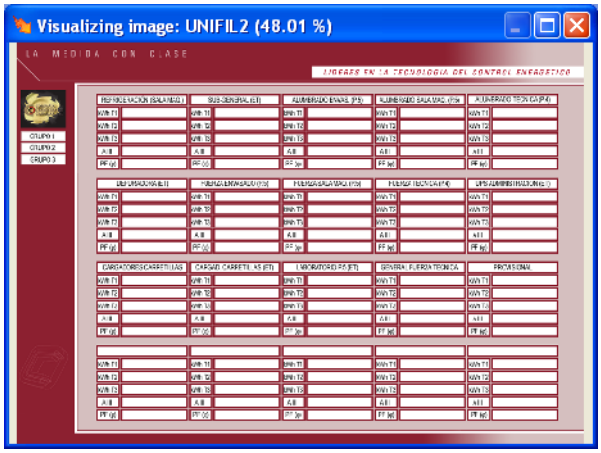
Finally, release the left mouse button for the change to take place.



If you want to copy images in another group proceed in the same manner as with the copy of groups by Clicking CTRL before releasing the left mouse button.

When clicked the selected image will be automatically removed. PowerStudio will delete the copy created and will not delete the original stored on the PC.

Display the image by clicking twice on one of the images:



2.2.7 Reports

Using this option, reports can be added, modified or deleted. This section will be explained in more detail in Chapter 7.

2.2.8 Screens

Using this option the different screens that make up SCADA can be added, modified or deleted. This section will be explained in more detail in Chapter 8.

2.2.9 Events Timetables

This option allows us to configure the different disabling of events timetables. This section will be explained in more detail in Chapter 10.

2.2.10 Groups of events

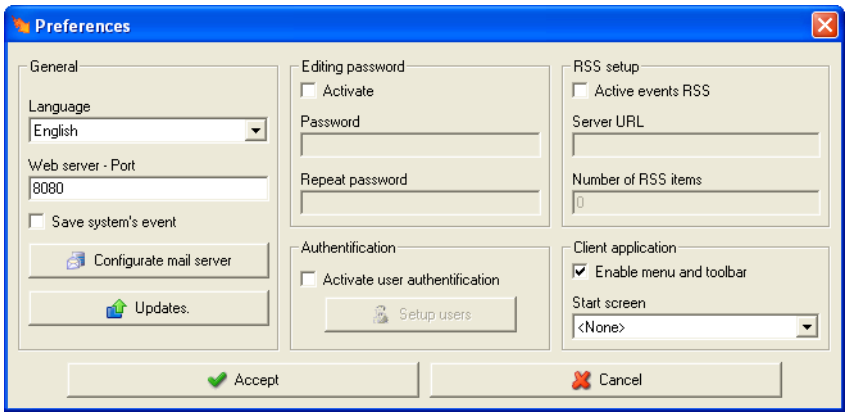
Using this option event grouping can be configured. This section will be explained in more detail in Chapter 10.

2.2.11 Events

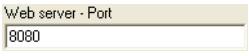
This option is used to configure a series of events in the software, configuring a disable timetable for the event or carrying out a series of actions when the event comes about, while it is active and when the event finishes. This section will be explained in more detail in Chapter 10.

2.2.12 Preferences

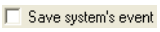
This option can be used to configure a series of general parameters for the application.



Using this selector, the application language can be selected.

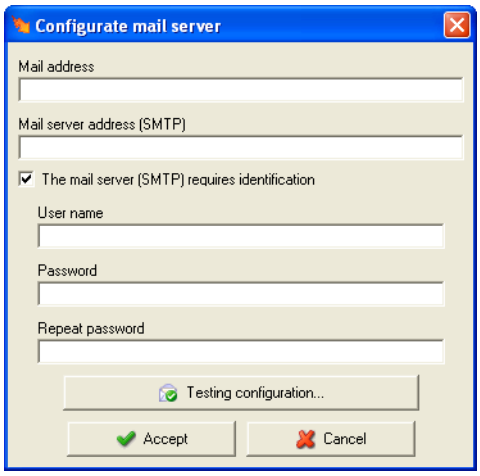


The option of using the application as a Web server, we can use the internet browser to display the measurement parameters for the devices connected to the local PC (see Chapter 12).



Will indicate to the software if an events log should be saved or not. If it is decided to keep the system events, a table, with the various activities taking place in the system can be seen, such as when a user accesses a SCADA screen or is denied access.

Allows the mail server to be configured to make it possible to send e-mails during events (see section 10.3.2.3 Send mail).

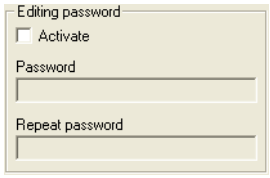


Where the '*E-mail address*' of the sender,' and the *Mail server address* (SMTP) 'should be indicated and the authentication of the mail server enabled if necessary.

Once configured it will be possible to test if the configuration is correct by clicking on the button "Check configuration." on clicking this button an e-mail will be sent to the sender or an error message on the contrary.

For information on which parameters must be entered into the mail server configuration, contact your system administrator.

Through this option updates can be easily made on the software properties. This preference will be explained in more detail in section 2.2.12.1 Updates.

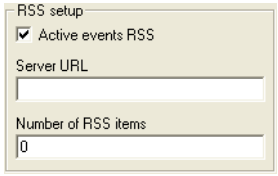


The blocking possibility can be

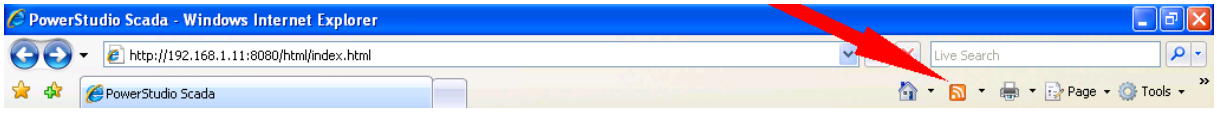
; enabled or disabled

; using this password on the edit mode. This password should be a word with a maximum of 8 characters.

Similarly, using the '*Activate User Authentication*' the name and password of the user trying to access on a remote PC can be requested, in order to allow access to some of the resources of the application and deny access to the rest of the resources. The '*Configure users*' button will allow the resources that each one of authorised users can access to be configured. User configuration will be explained in detail in section 2.2.12.2.2 Users. If the option '*Save system events*' is enabled, the actions performed by users will be saved, whether they have been granted access to the resource or if they have been denied it.

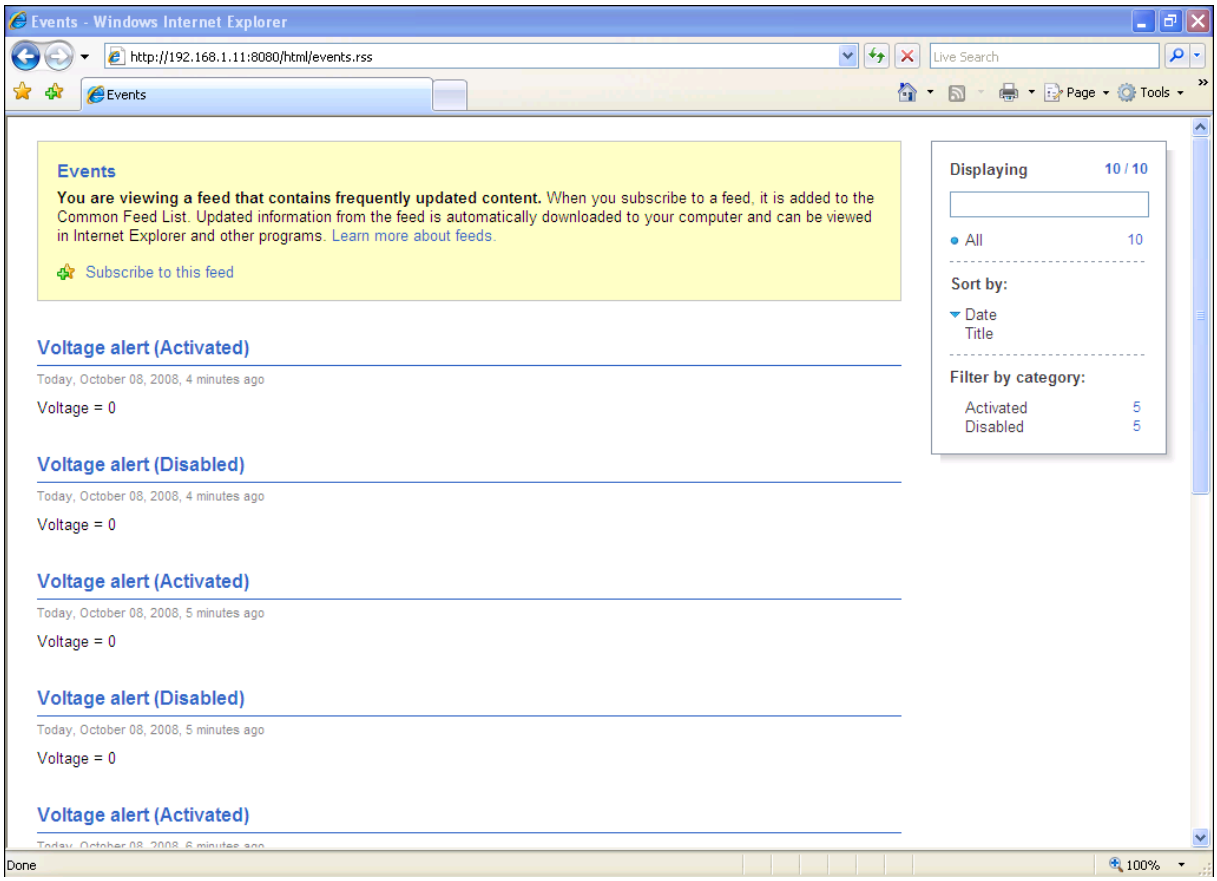


The engine can be configured as a RSS content producer so that we can generate news related to the events which can be consulted by any RSS news reader (available free for almost any platform and environment). To do so we activate the corresponding box in the window '*Configuration of the RSS feed*' and configure the two required fields. In the '*URL server*' field the address to which the HTML server is configured is added and in the '*Number of news feeds*' we add the maximum number of news stories we want to publish (stories are published in a circle, so that when the maximum number of stories are published the oldest are removed to continue publishing new stories). Typically browsers detect that the server contains an RSS feed and allow access thereto (subscribe).



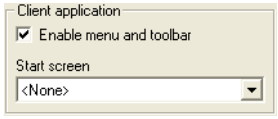
Message on the Internet Explorer about the RSS FEED found

For example, the RSS newsreader provided by Internet Explorer would allow us to consult the news published by the engine, and is displayed as follows:



Displaying the RSS news released by the Engine/ Editor on the Internet Explorer

Of course, there are other RSS readers who view the news in various forms for almost any environment imaginable, including mobile devices, PDAs, etc. Note that each incident must be configured if we want to publish RSS news related with it or not.

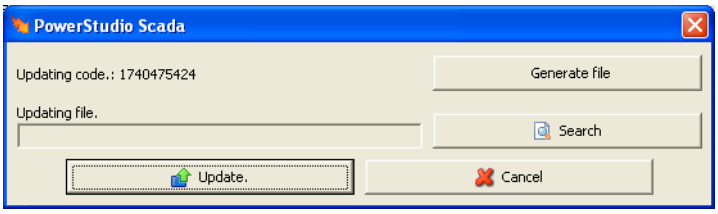


Permits the menu display and toolbar on the Java Client to be enabled '☑'; or disabled '☐'. It also lets us set up the initial screen when the application is displayed through the Java Client. See chapter 12 Access through the PowerStudio Client.

2.2.12.1 Updates

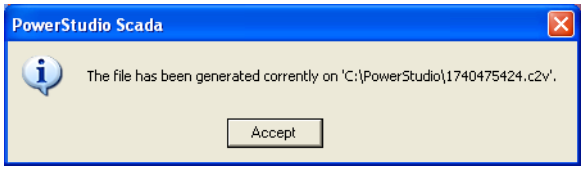
In cases where you have a version of the software and want to upgrade or expand this limitation, updates should be from the USB key.

Clicking on the 'Updates' button in the 'Preferences' dialogue the following window will appear.



To update follow these steps

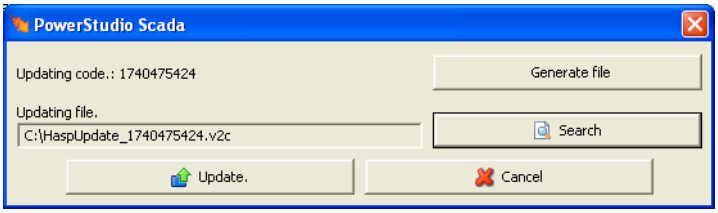
1. Click on the 'Generate file' button. This button generates a file with the information necessary to ensure the update. Once the file has been generated the following message will appear:



   Informing where the file with the c2v extension containing software information has been generated.

2. Send the file produced in the previous step to its usual distributor, so you can create the updated file. You should wait for your distributor to send you the updated file, with the v2c extension, to continue.

3. Once your distributor has sent the updated file, click on the '*Search*' button to select the file.



   In this case the file is' HaspUpdate_1740475424.v2c 'which can be found in the root directory on your hard drive.

4. Click on the '*Update*' button and wait until the end of the update.

Whenever necessary an update should be made carrying out the steps described previously.
The file sent by your distributor, with the extension v2c will only serve for one update, which is why after the update it can be deleted.
It will only be possible to update USB keys. It will not be possible to update parallel keys.

2.2.12.2 User Authentication.

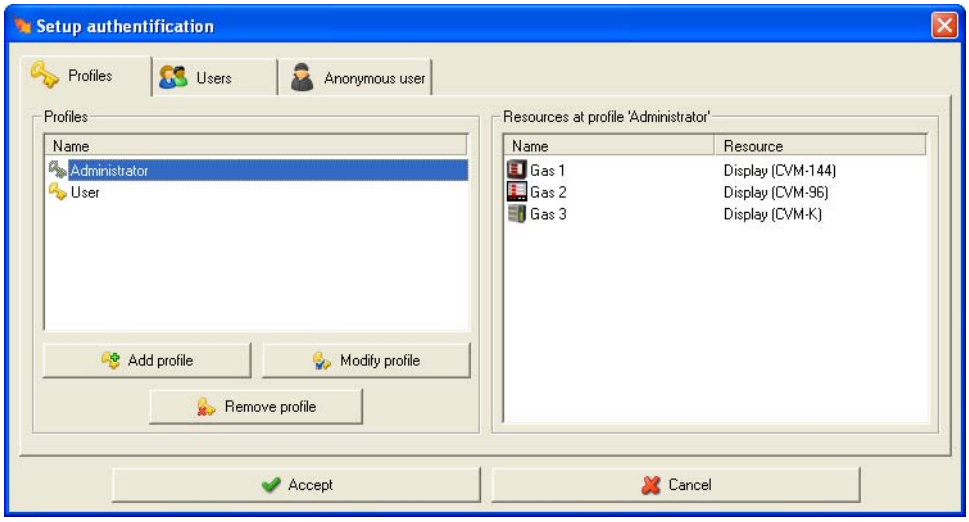
This section will explain how remote user access to the resources of the application can be configured.

A series of profiles are defined. These profiles contain the resources that can be accessed; a resource can be assigned to more than one profile.

Similarly, users are defined as those who are authorised to access the application resources. Each user will have a name and a password, enabling the application to identify them, avoiding non-authorised user access. Each authorised user will be assigned one or more profiles, allowing access to all the resources contained in profiles. A profile can be assigned to more than one different user.

Finally the access to an anonymous user can be enabled. This anonymous user will not have a name or a password, allowing access to any remote user without a need for identification. Similarly, one or more profiles will be assigned to the rest of the users, allowing access to the different resources of the application.

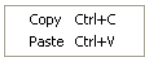
2.2.12.2.1 Profiles



Using this dialogue box the different profiles used for remote access to the application resources are defined.

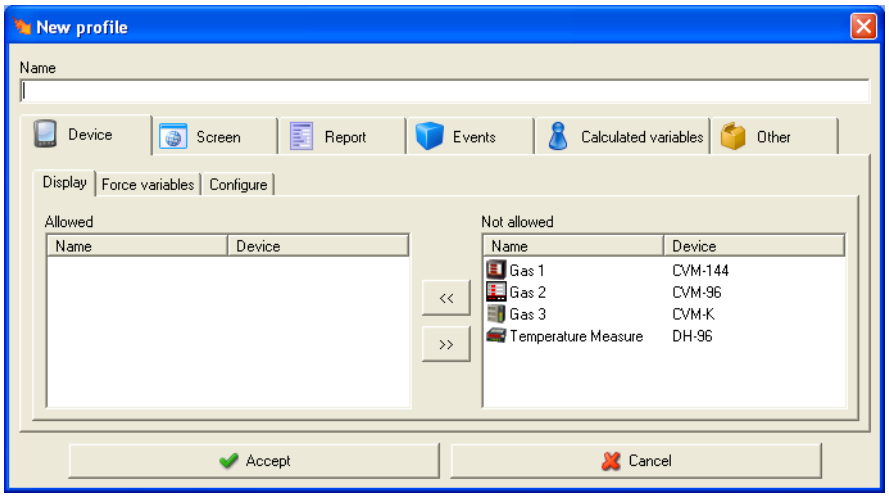
The list situated to the left of the dialogue contains the profiles, while the right-hand list shows the resources associated to the selected profile.

Click on the right button on the mouse on the list of profiles to show the contextual menu,



enabling styles to be pasted and copied. Some of the options from the contextual menu may not appear, copy will only appear if there is a profile selected on the list and the paste option only if the styles have been previously copied onto the clipboard. If no profile is selected and there are no styles on the clipboard when the right button is pushed, the contextual menu will not appear.

Clicking on ‘Add profile’ or ‘Modify profile’ will bring up the following dialogue box:



In this dialogue box the name and resources of the profile will be added or modified depending on the button chosen. This name used to identify the profile will be unique; two profiles cannot exist with the same name.

The list situated to the left of the dialogue shows the resources added to the profile that can be used by the users who have that profile assigned, while the left-hand list shows the resources that the profile user does not have access to.

To add resources to the profile, "*Not Permitted*" should be selected from the resource list and passed onto the "*Permitted*" resource list using the '<<'; button, whereas if we want to delete resources from the profile the opposite should be carried out, select "*Permitted*" from the list and click the '>>'; button to pass over to the "*Not Permitted*" list.

The different types of resources that can be added to a profile are:

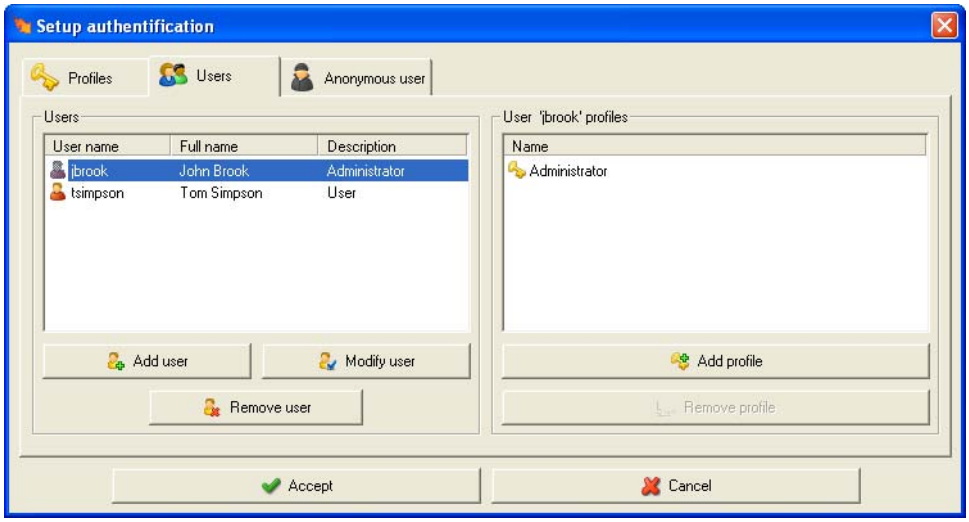
- ***Devices:*** Devices configured on the software.
  - ***Visualise.*** Allows the chosen devices to be visualized.
  - ***Force variables:*** This allows the variables values of the devices to be forced. Only devices where it is possible to force one or more variable can be shown, for example digital outputs.
  - ***Configure.*** Allows certain parameters of the devices can be configured. Only devices where it is possible to configure parameters while on the execution mode will be shown.
- ***Screens:*** Will show the different SCADA screens which configure the application. See section 2.2.8 Screens.
  - ***Visualise:*** Enables the chosen screen to be visualised.
  - ***Force Variables:*** Permits variables to be forced using the "force variable" controls on the SCADA screens.
- ***Reports:*** Shows the defined reports. See section 2.2.7.
- ***Events:*** Will display the various events resources (see section 2.2.1.1 Events) that can be added to a profile:

- *Run event actions on client application.* Will enable programmed actions to be carried out on the client application when enabled, acknowledged, disabled or while events are being produced.
- *Recognise notified events.* Allows a notified event to be acknowledged.
- *Visualisation of active events.* Allows active events to be displayed or not.
- *Visualisation of notified events.* Allows events which need to be notified to be displayed or not.
- *Visualises event variables:* Allows graphs and tables of the variables generated by the events to be displayed (see section 10.4 Event variables)
- *Display event browser.* Enables the list of events stored on file, notified or not, to be seen.

➢ ***Calculated Variables:*** Allows graphs and tables of the calculated variables configured on the software to be displayed (see section 2.2.4 Calculated variables)

➢ ***Others:*** Allows the table with the events of the system to be displayed.

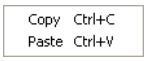
2.2.12.2.2 Users



Using this dialogue box the users, who have access to the application resources, are defined.

The list situated to the left of the dialogue contains the configured users, while the right-hand list shows the profiles associated to the users selected from the user list.

Clicking the right-button on the mouse over the list of users the following contextual message will appear:



allowing users to be copied or pasted. It may be possible that some of the options from the context menu do not appear, copy will only appear if there is a user selected and the paste option only if the users have been previously copied onto the clipboard. If no user is selected and there are no users on the clipboard when the right mouse button is clicked the context menu will not appear.

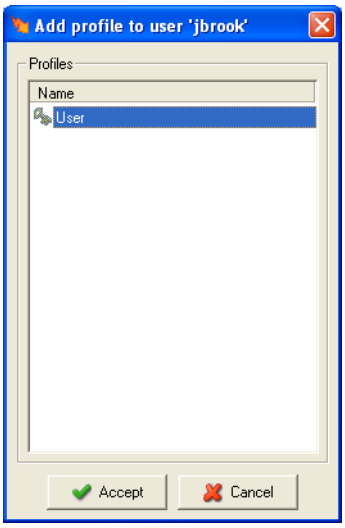
To add or modify a user, click on the button corresponding to ‘Add user’ or ‘Modify user’.

Where:

- **User name:** Will be an alphanumeric field which uniquely identifies the user. This field will be used to identify the user when necessary.
- **Full name:** Corresponds to the user's Full name.
- **Description:** Field which permits a brief description of the user to be entered.
- **Password:** Password which serves to avoid unauthorised users accessing the application resources.
- **Confirm password:** Field which serves to validate the password entered in the previous field. The values entered in the 'Password' and 'Confirm Password' must be the same in order to consider the password valid.

If we want to delete one or more users, select those users we wish to delete from the user list and click "Delete User" button.

Click on the "*Add Profiles*" button and new profiles can be assigned to the user selected from the user list.

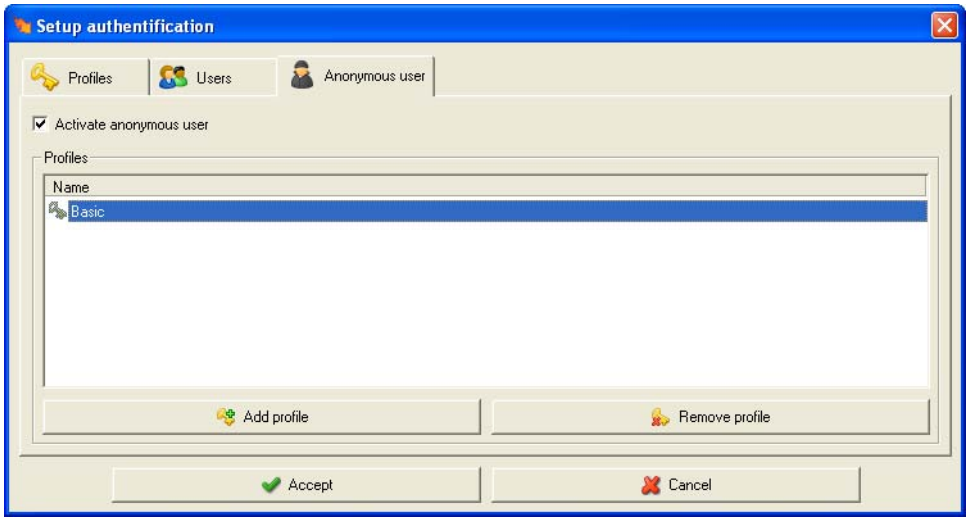


The dialogue will only show those profiles which have not been previously assigned to the user. In this case for the user "*jbrook*" only the "User" profile will be shown as it is the only one which has not been assigned to the user. On choosing "Accept" the profiles selected from the list will be assigned to the user.

If we want to delete a user profile, select those profiles we wish to delete from the user and click "*Delete profiles*" button. Bear in mind that these profiles are only deleted from the user profile list and in no case are they deleted from the application.

2.2.12.2.3 Anonymous User

There is a special type of user that from now will be known as anonymous user. The main difference between this type of user and the other users is that they do not have a name or a password. The anonymous user can access the application resource to which they have access without having to enter a name and a password. To avoid non-authorised access, this user can be disabled to have greater control over those who can access the resources and those who cannot.



Enabling or disabling the "Activate anonymous user" option will activate or not the option to permit the anonymous user by way of the Java Client.

The list will show the profiles assigned to the anonymous user, with the "*Add profile*" and "*Delete profile*" buttons working the same as those of any other user (see section 2.2.12.2.2 Users)

2.2.13 Operating mode:

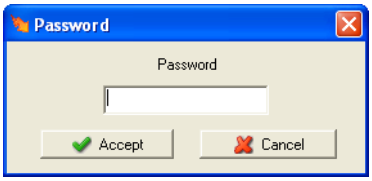
There are two possible operating modes: edit and run.

In the run mode the Java Client allows you to communicate with the PowerStudio engine to view the values of the devices, make charts and tables of the data saved, display SCADA screens and reports and perform other functions not involving the modification of the configuration, in general software terms or individually for each device, except for some equipment which allows some of its features to be changed, whenever the user connected has sufficient permission to make this change.

In the edit mode, it will be possible to modify the configuration parameters for the software and the configured devices. In this operation mode it will be possible to edit the SCADA screens and reports and actions such as adding display controls, modifying controls, etc. can be carried out. Once the SCADA screens have been edited it will be necessary to move onto the run mode to run the screens. The Java Client cannot communicate with the engine while it is in the edit mode.

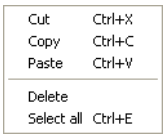
We can use a password, to block the edition mode, avoiding possible modifications of the configuration, whether by error or by non-authorised personnel. To enable the edit password select the most suitable option in the Preferences dialogue (see section 2.2.12 Preferences).

On moving from the run mode to the edit mode, and with the edition password enabled, the correct password should be entered in the following dialogue box:



Otherwise, you will not be able to enter the edit mode.

2.3 Edit Menu



The options from this menu are only enabled when editing SCADA screens or reports.

2.3.1 Cut

Using this option the controls selected are copied onto the clipboard and are deleted from the editor.

This option is only enabled if there is at least one control selected on the editor.

2.3.2 Copy

Using this option the controls selected are copied onto the clipboard. Unlike the "*Cut*" option the controls are not deleted from the editor.

This option is only enabled if there is at least one control selected on the editor.

2.3.3 Paste

Using this option the controls previously copied from the clipboard can be pasted onto the clipboard.

This option is only enabled if the clipboard contains valid controls for PowerStudio.

2.3.4 Delete

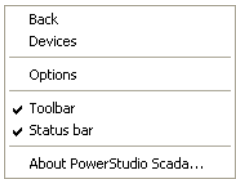
Using this option the selected controls are deleted.

This option is only enabled if there is at least one control selected on the editor.

2.3.5 Select All

Using this option all the SCADA control screens or a report can be selected.

2.4 See Menu

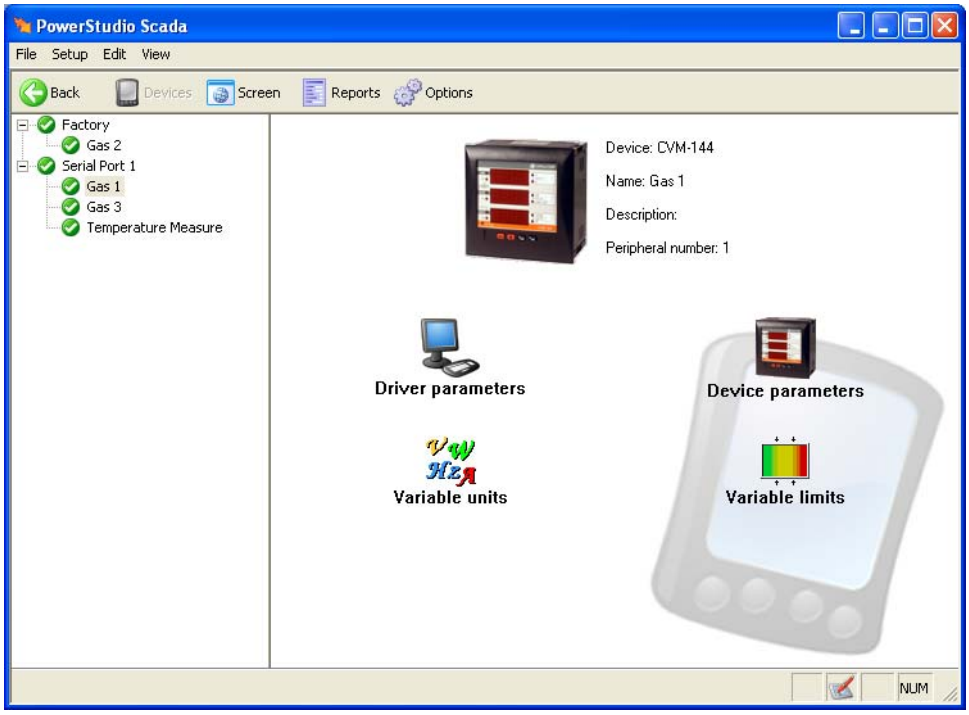


2.4.1 Back

This option allows us to go easily to the previous screen.

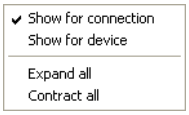
2.4.2 Devices

Clicking on the devices will open a screen similar to the following:



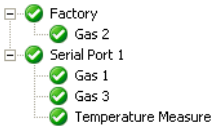
It is also possible to view this clicking the "Devices" button on the toolbar.

The tree on the left of the window shows the status of all configured devices. By clicking the right mouse button on the tree the following context menu will appear:

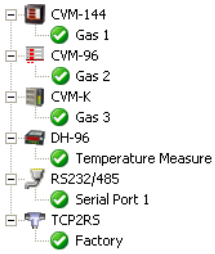


Where the different options are:

- **Show by Connection:** The devices are shown as they have been entered onto the device screen (see section 2.2.1 Devices), where the first and second-level devices are displayed.

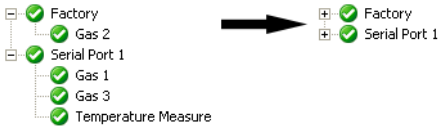


- **Show as per device:** The devices will be classified according to the type of device.



- **Expand all:** Clicking on this option the entire tree will drop down, showing all the devices.

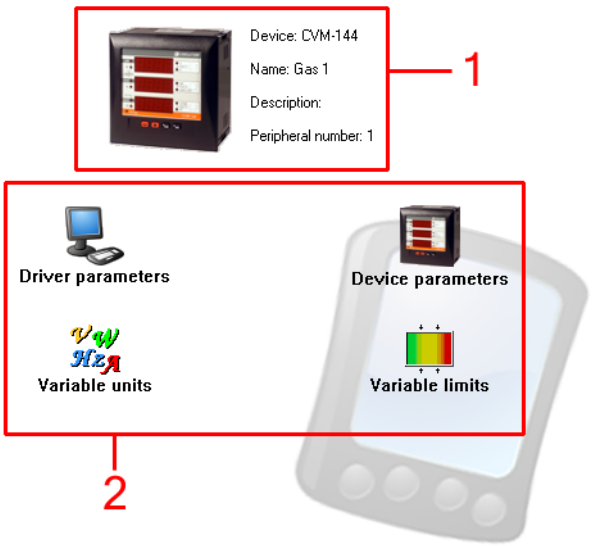
- **Contract all:** Clicking on this option will hide second-level devices.



We may find the following states are possible:

- **OK:** The equipment communicates properly.
- **Downloading of the device:** We are downloading data from the device at this time.
- **Error in connection:** The connection where the device can be found presents problems.
- **Device not started up:** Attempts were being made to establish communication with the equipment at this time for the first time. This process is necessary initially to ascertain the configuration of the equipment.
- **Failed communications:** Unable to establish communication with the equipment, response time is exceeded.
- **Incorrect version:** The equipment communicates correctly but it is a version which the programme does not support. Perhaps it is an old version.
- **Phase error:** The equipment communicates correctly but some phase connection is incorrect.
- **Channel error:** Unable to open the communication port. This action must be carried out to establish communication with the device.
- **Failed communications:** Some of the devices connected to this equipment do not communicate properly.
- **Camera transmitting images:** The engine is receiving images from the camera as a customer application is requesting them.
- **Camera paused:** The engine is not receiving images from the camera as they are not being required by any client application.
- **Error on the memory card.** The SD Memory Card is invalid, write-protected or not present.

The information found on the right side of the window:



Contains general information about the device selected on the tree (1) and different device settings (2). These settings can be found only on edit, and are hidden when the software is running, and will also be accessible by clicking the '*Options*' button on the toolbar.

2.4.3 Display options

Contains the parameters to modify the Java client display screens of the device values.

This menu option will depend on what is being shown on the screen, and will be explained in the corresponding sections, when the devices, tables and graphs are explained.

2.4.4 Toolbar

With this option the toolbar can be displayed or hidden.

This bar contains the main elements of the View menu.

- ***Back:*** See section 2.4.1
- ***Devices:*** See section 2.4.2
- ***Screen:*** See section 2.2.8
- ***Reports:*** See section 2.2.7
- ***Options:*** See section 2.4.3

2.4.5 Status Bar

With this option the status bar can be displayed or hidden.

To the right of the bar is a series of icons showing, where necessary, information on the status of the program. Double-clicking on the corresponding icon will show additional information on the meaning of each one of them.

The icons shown are:

Initialisation of devices. Shown while starting communication with the devices.

Communication error. Shown when communication is not possible with at least one of the devices.

Edit mode. Shown to indicate that the programme is editing.

2.4.6 About

Shows information on the software.

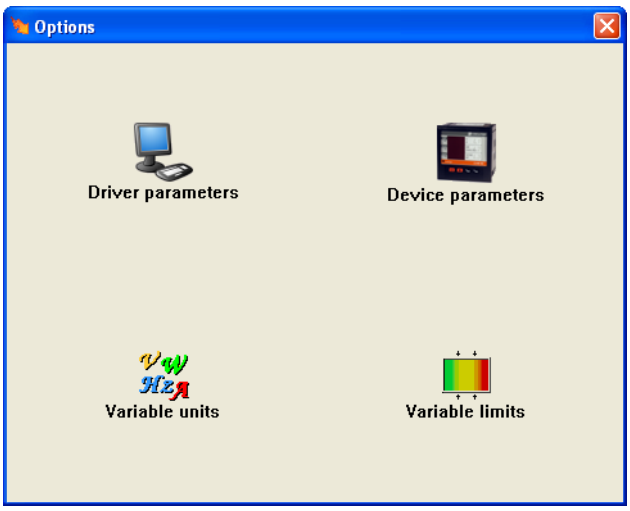
3 Devices

3.1 Drivers Option Configuration

The options of a device can be accessed from

- *See Menu* See section 2.4.3 Display Options.
- *Toolbar* See section 2.4.4 Toolbar

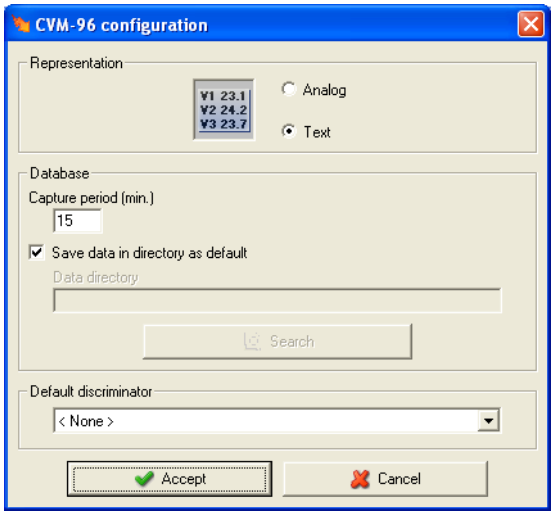
The options menu for a CVM-96 device will be the following



In this section those options which are common to all or the majority of the drivers are described.

These options are described using device CVM-96 as an example. It is possible that other devices need to configure other types of option, not described in this section, in which case detailed explanation will be contained in the corresponding device section.

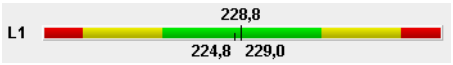
3.1.1 Driver Parameters



From this screen we can configure the type of display of the variables on screen and configure where to save the data files.

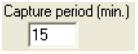
There are two types of data representation.

Analogue representation, the variables are graphically represented by bars as



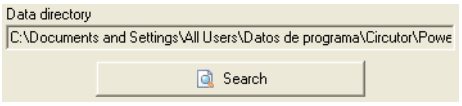
Here the instantaneous value, maximum and minimum values are represented.

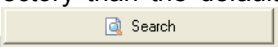
Text mode representation, the variables are represented as



In this field the capture period is entered in minutes. This indicates the time interval which elapses between the registers stored of the device.

Checking this option will indicate that the data read from the devices will be stored in the default directory where the software saves all the data. Should you wish to store the data in a directory other than this default directory, this option must be unchecked and the directory entered into the 'Data directory" field.

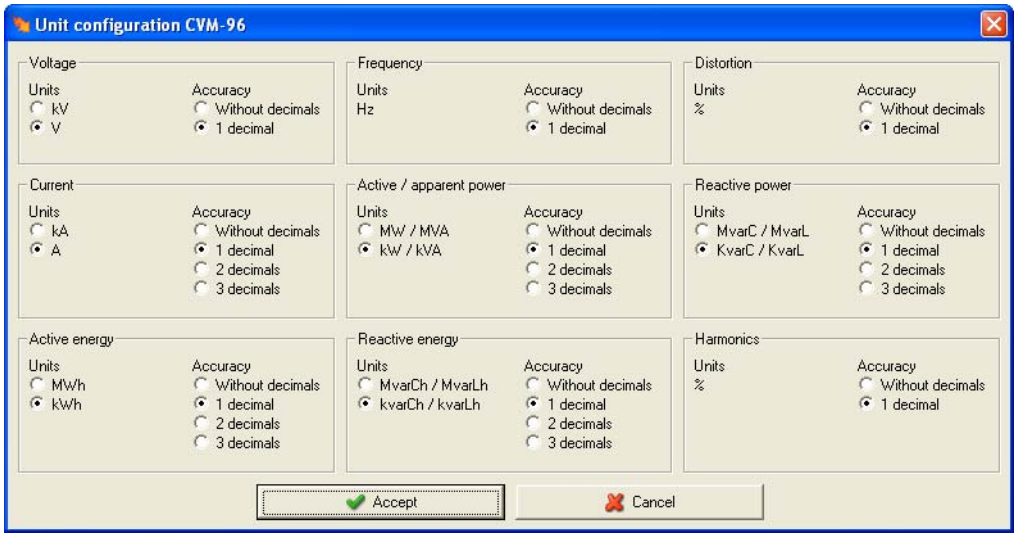


Should you wish to store the data in a different directory than the default one, this area displays the directory where such data is stored. Clicking on 

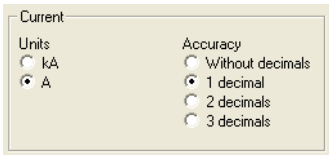
; will change the data directory.

This selector will assign a default discriminator to the device. This option appears only in those devices possessing variables that can be discriminated. If we select a discriminator, when making graphs or tables, the variables are displayed initially as discriminated, although it is also possible to see the variables without discrimination, or see them through another discriminator other than the default one.

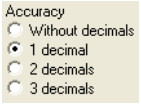
3.1.2 Variable Units



Using this dialogue the units can be configured and the number of decimals with which to display the variables on screen. This type of configuration does not affect the equipment, being used only for displaying the values on screen.

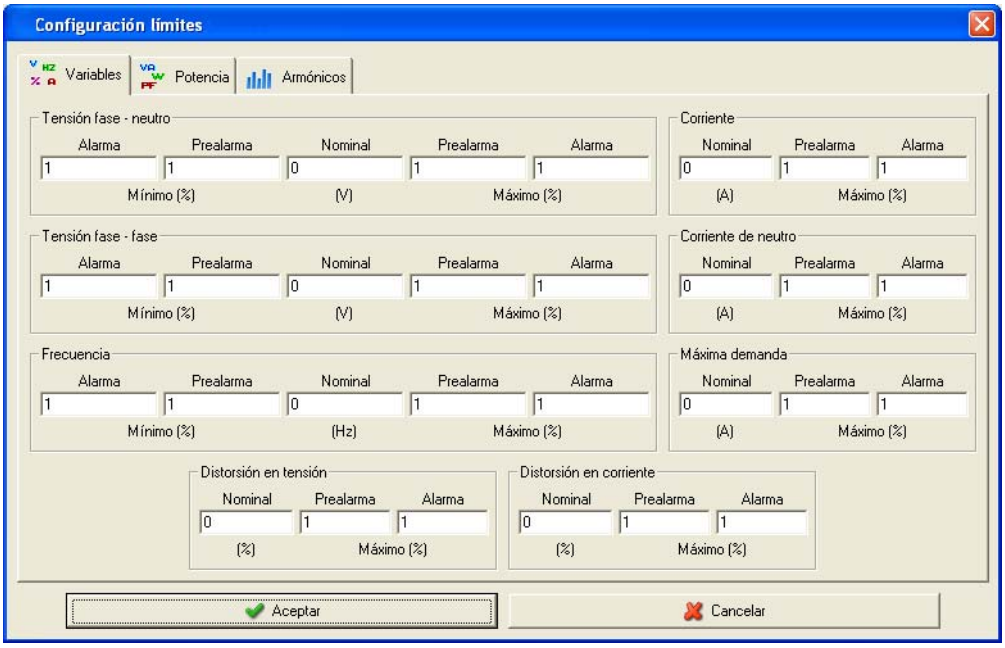


The units in which the variables are shown are selected. In this case all the current variables will appear in A.

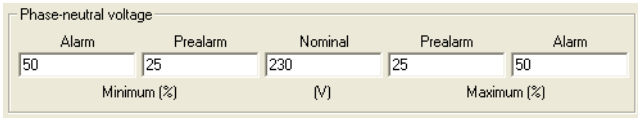


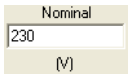
The precision when displaying the variables is selected. In this case all the current variables are shown with 3 decimals.

3.1.3 Variable limits

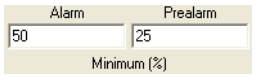


Using this dialogue the nominal values of the variables are configured, as well as a series of margins to display on screen when a variable measures unusual values.

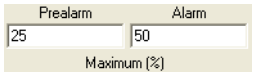




The nominal value of the variable. The units used to express this value are indicated in the brackets. If the nominal value is 0, the alarm is disabled. For the power factor, the nominal value should be 1 to enable the alarm or 0 to disable it.



Percentage of nominal value for the pre-alarm or alarm signal. In this case when the variable value is between 25% and 50% below the nominal value, there will be a pre-alarm signal, if it is below 50% the signal will be an alarm. For the power factor the desired alarm and pre–alarm alarm between +0.0 and -0.0. are entered.



Percentage of nominal value for the pre-alarm or alarm signal. In this case when the variable value is between 25 and 50% above nominal value, there will be a pre-alarm signal, if it is above 50% the signal will be the alarm. For the power factor the desired alarm and pre–alarm alarm between +0.0 and -0.0 are entered

If the pre-alarm value is equal to the value of the alarm, the pre-alarm zone will be disabled passing directly from the normal state to the alarm status.

3.2 C-14d

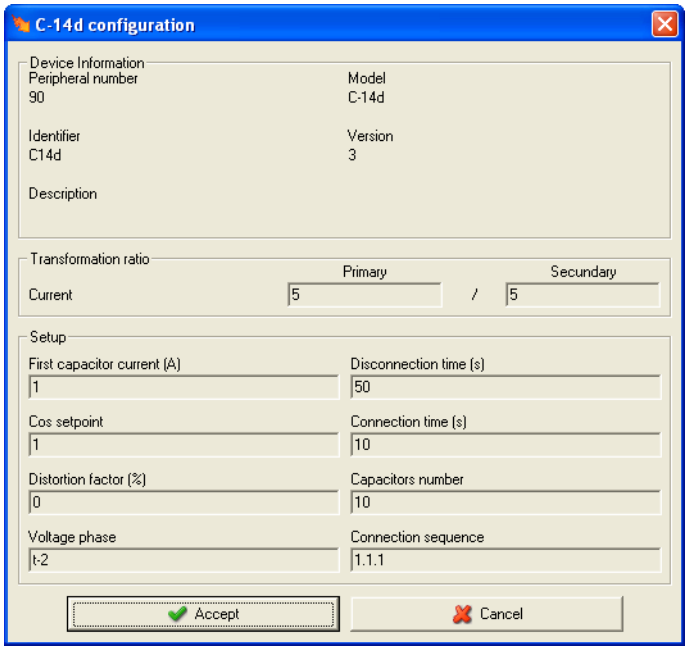
3.2.1 Driver options

The following is the options menu:

The options "*Variable Units*" and "*Variable Limits*" are detailed in 3.1.2 Variable units and 3.1.2 Variable limits.

3.2.1.1 Device parameters

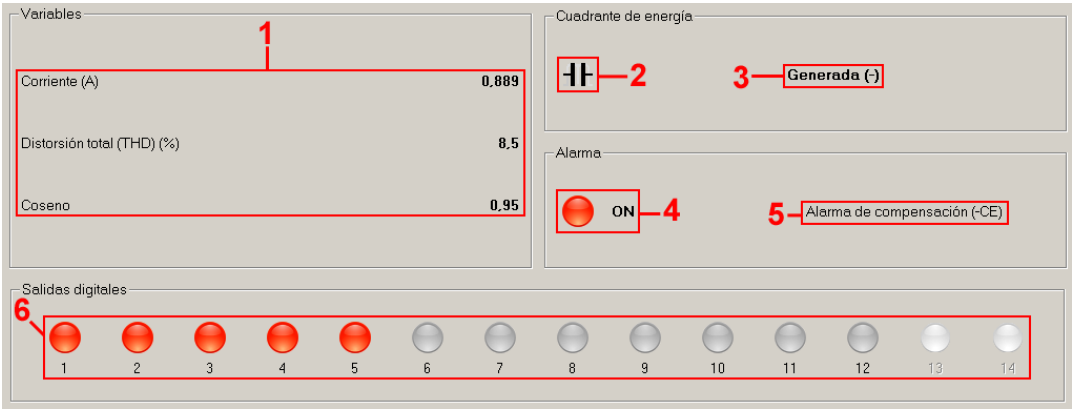
In the case of C-14d it will not be possible to configure any parameters of the device, only information about it will be shown.



3.2.2 Displaying Values

This part can be observed in the operation mode "Run" using the Java Client to display it.

This C-14d device will show the following value screen:



Where:

1. Instant values measured by the device
2. Energy Quadrant
   - Inductive
   - Capacitive
   - Cos Phi = 1
3. Description that indicates if the energy is consumed or generated.
4. Alarm status:
   - Status OFF. Alarm disabled
   - Status ON. Alarm enabled.
5. Description of the enabled alarm. Will not appear if no alarms are enabled.
6. Status of the output relays:
   - Relay disconnected.
   - Relay connected.
   - Relay disabled. The relay is not used by the device.

3.3 IP Camera

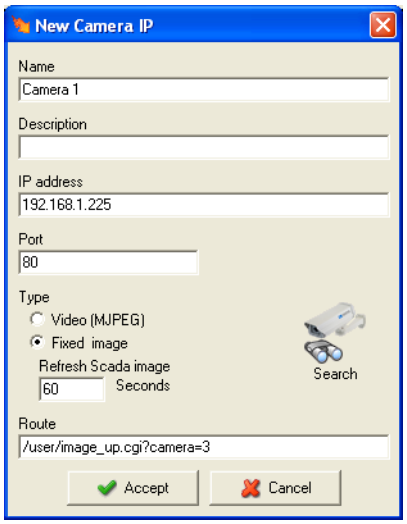
The IP Camera device only allows a captured image to be displayed, either by connecting directly with a camera with an Ethernet connection, a video recorder to which petitions can made or webcams.

It will not be possible to record, display recordings or carry out any other action on the image displayed, such as motion detection, from the sources described beforehand.

The IP Camera device can display images generated from different sources (IP cameras, videos, webcams, etc…) provided web requests can be made to these sources and the response is a still image in JPEG format or video streaming format MJPEG.

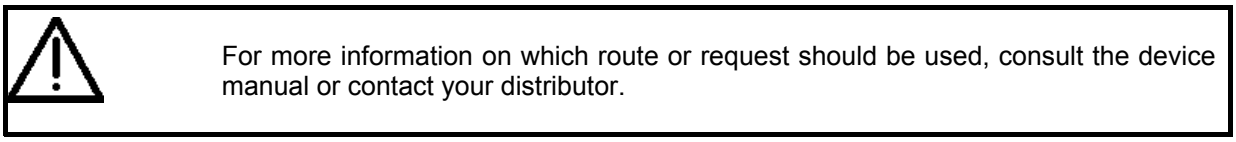
3.3.1 Adding an IP Camera

For more information on how to add a device see section 2.2.1 Devices. The following parameters are used to configure communication with an IP camera.



- **Name:** Alphanumeric field which uniquely identifies the device throughout the program. There are no two devices in the configuration with the same name.
- **Description:** Alphanumeric type data to enter a brief description of the device.
- **IP Address:** Corresponds to the address through which the program can communicate with the device. This parameter can be an IP address or a name.
- **Port:** Corresponds to the communications port.
- **Type:** Type of image returned by the device. We can choose between displaying a video in MJPEG or a still picture
- **Refresh each image:** Only needs to be set when it is a fixed image and it dictates how often in seconds the program should ask to obtain a new image.
- **Route / Request:** Corresponds to the request that must be made to the device to obtain the video or image requested.

- **Search:** By clicking on this button, the program will try to find the device at the address and port configured, using the most frequent routes / requests.



For more information on which route or request should be used, consult the device manual or contact your distributor.

3.4 CBS-4 /CBS-4 RA

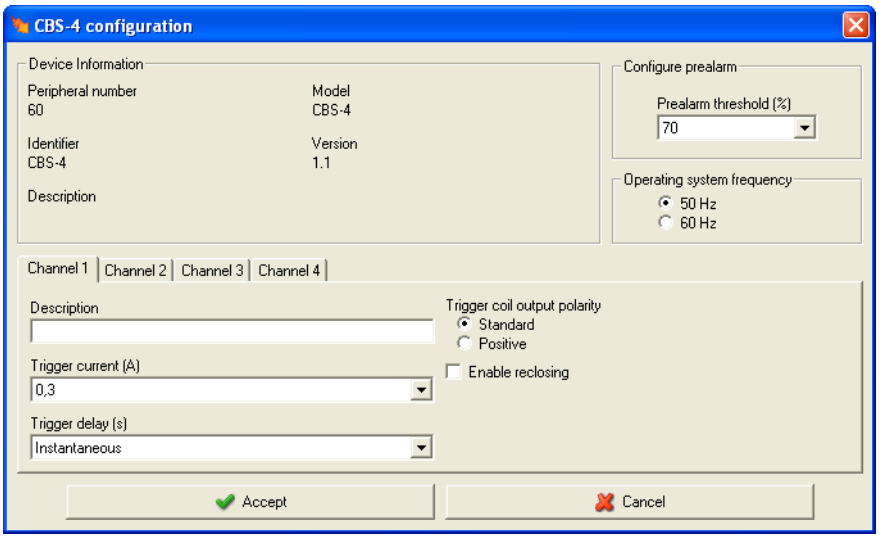
3.4.1 Driver options

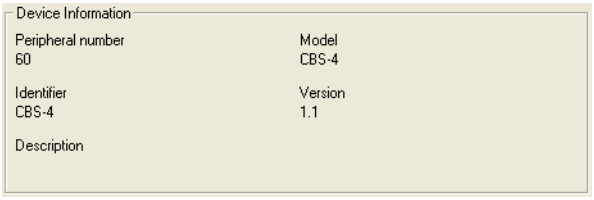
The following is the options menu:

3.4.1.1 Device Parameters

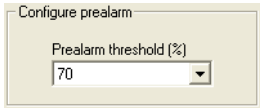
This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

3.4.1.1.1 CBS-4

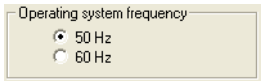




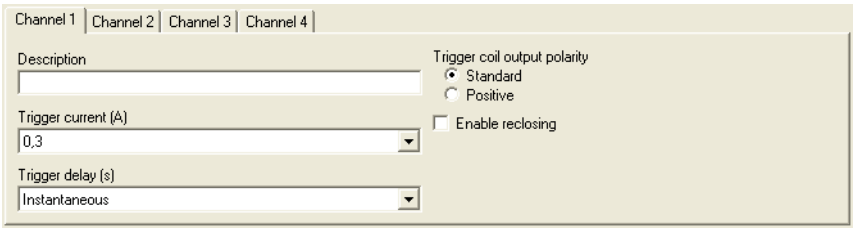
Shows general information about the device.



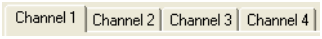
Pre-alarm threshold the equipment possesses. This can vary between 50 and 100% of the minimum trip threshold of the device channels.



Enables the frequency of the working network where the device is connected to be selected.



Shows the channel configuration.



As it is only possible to display the configuration of one channel at a time, click one of the channels and the selected configuration can be displayed.

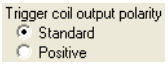
Alphanumeric type information where a brief description of the channel can be entered for easy identification.

Indicates the maximum current that can be reached by the device before triggering. The values that can be acquired are:

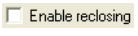
Disabled	0.03 (A)	0.1 (A)
0.3 (A)	0.5 (A)	1 (A)
3 (A)	5 (A)	10 (A)
30 (A)		

Channel delay time, the possible values are:

Instantaneous:	Selective	20 ms
100 ms	200 ms	300 ms
400 ms	500 ms	750 ms
1s	3s	5s
10s		

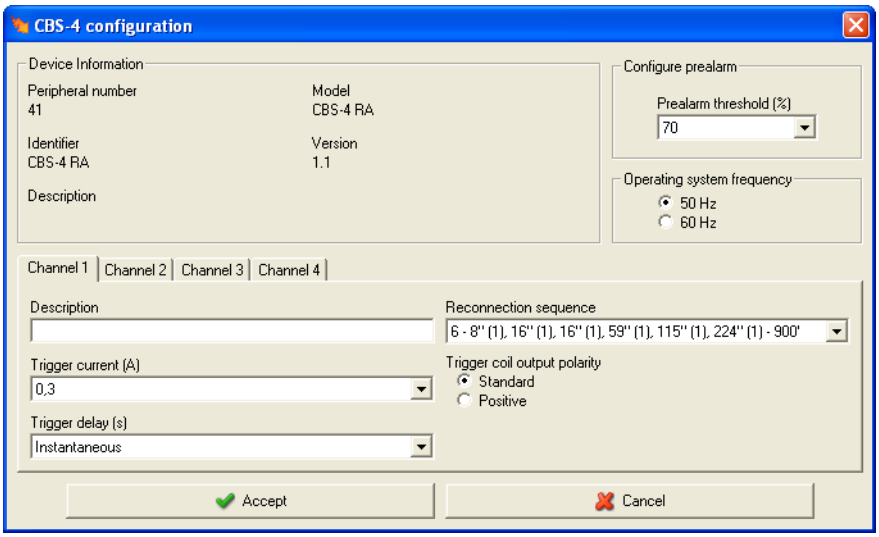


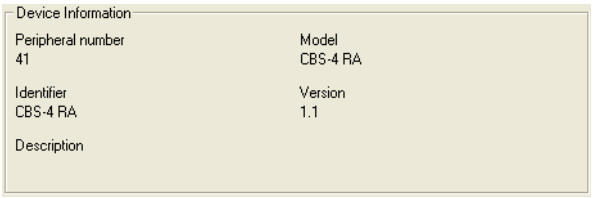
Configuration of the polarity of the output relay of the trigger coil, allowing one of the two options possible to be selected (standard or positive).



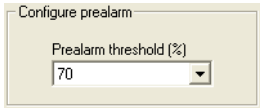
If this option is selected, when triggering takes place, the device will try to reconnect the channel.

3.4.1.1.2 CBS-4 RA

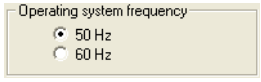




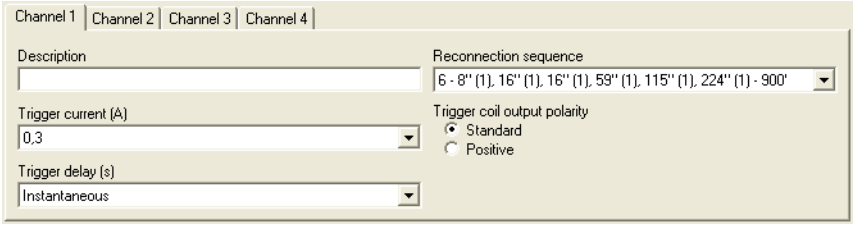
Shows general information about the device.



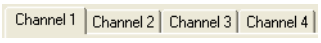
Pre-alarm threshold the equipment possesses. This can vary between 50 and 100% of the minimum trigger threshold of the device channels.



Enables the frequency of the working network where the device is connected to be selected.



Shows the channel configuration.



As it is only possible to display the configuration of one channel at a time, click on one of the channels to display the corresponding configuration.

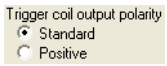
Alphanumeric type information where a brief description of the channel can be entered for easy identification.

Indicates the maximum current that can be reached by the device before triggering. The values that can be acquired are:

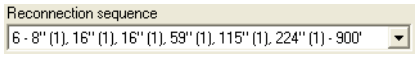
Disabled	0.03 (A)	0.1 (A)
0.3 (A)	0.5 (A)	1 (A)
3 (A)	5 (A)	10 (A)
30 (A)		

Channel delay time, the possible values are:

Instantaneous:	Selective	20 ms
100 ms	200 ms	300 ms
400 ms	500 ms	750 ms
1s	3s	5s
10s		

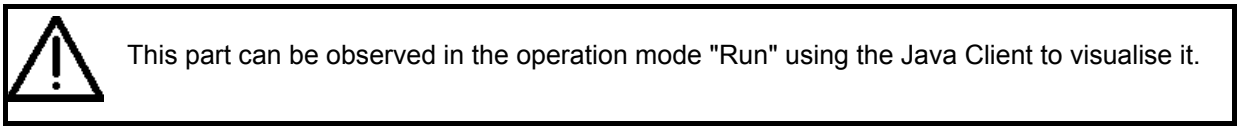


Configuration of the polarity of the output relay of the trigger coil, allowing one of the two possible options to be selected (standard or positive).



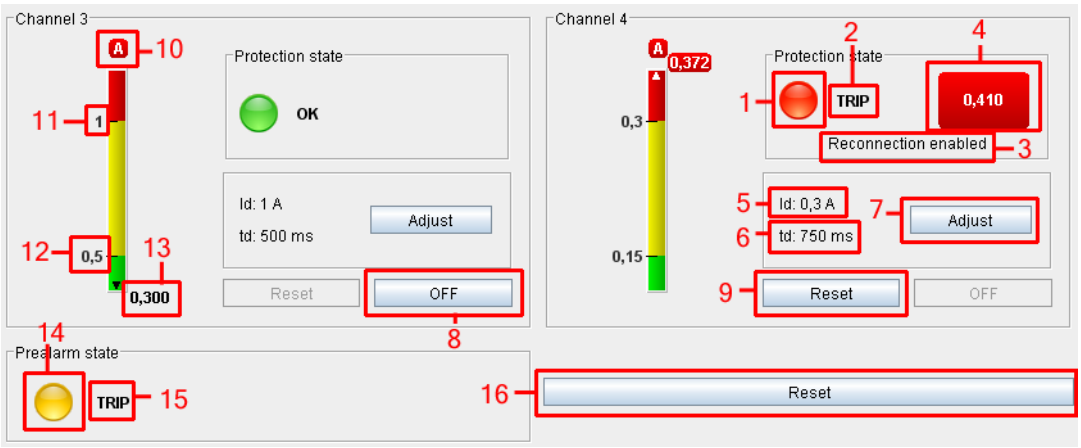
Enabling the channel reclosure sequence to be selected. The information shown will be xx – yy – zz where xx corresponds to the number of reclosures, yy to the sequence of time and zz to the reset time.

3.4.2 Displaying values



This part can be observed in the operation mode "Run" using the Java Client to visualise it.

In which:



1. Relay Status
   - Correct
   - Tripped.
2. Protection status:
   - Correct. Channel not tripped

- Toroid error. An error has been detected in the connection with the toroid coil.
- Trip. Channel tripped

3. Re-connection enabled. Informs that the reclosures for the channel have been enabled.

4. Earth leakage current value detected when the channel triggers. If the value detected is twice the trigger threshold configured it is shown in purple.

5. Trigger current configured

6. Delay time configured

7. Adjustment button. Enables the sensitivity and channel delay to be programmed.

8. Off button. External disconnection of the channel. The button will remain disabled if the channel has been triggered.

9. Reset button. Push the button to restart the channel. The button will remain disabled if the channel has not triggered.

10. Display units of the current values.

11. Trigger threshold value configured for the channel

12. Pre-alarm value configured for the channel

13. Instantaneous earth leakage current value of the channel. When the instantaneous earth leakage current value of the channel exceeds the limits of the values bar, either by excess or default, it will be indicated as shown in the figure (arrow in the bar).

14. Status of the pre-alarm:

    - Disabled status
    - Triggered status

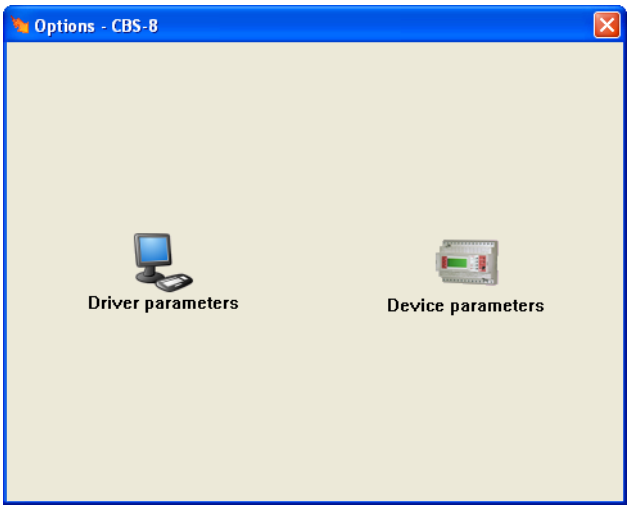
15. Additional information on the status of the pre-alarm.

16. Reset button. Resets all the device channels that are triggered.

3.5 CBS-8

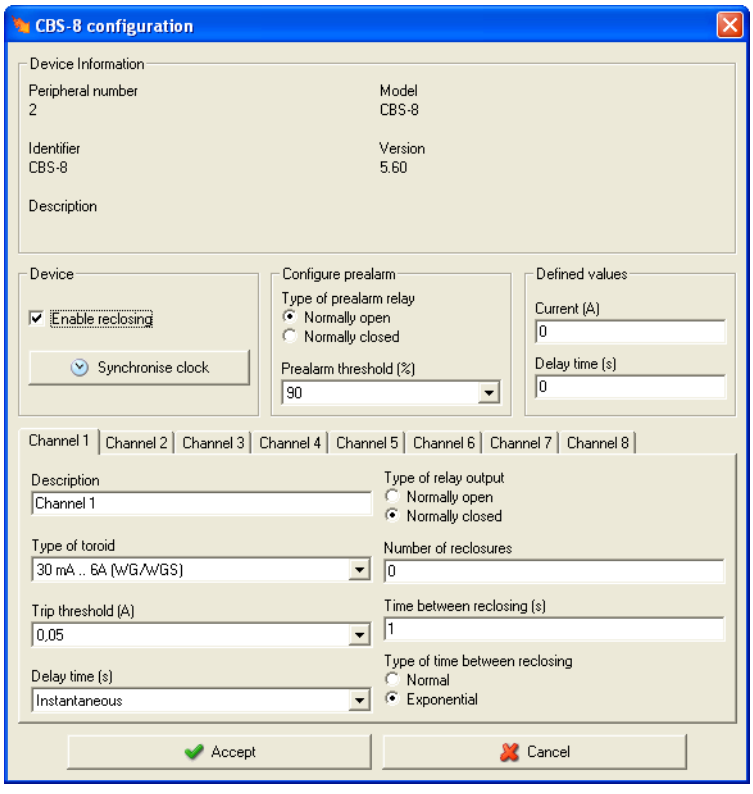
3.5.1 Driver options

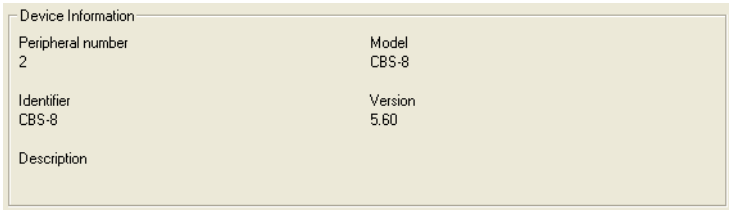
The following is the options menu:



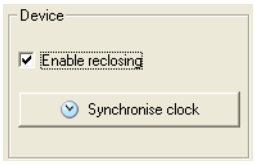
3.5.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

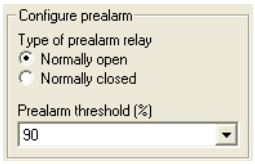




Shows general information.

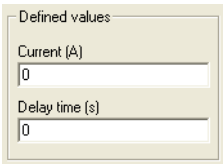


This selector allows the equipment to have the channel reclosures enabled or not. Depending on whether the reclosures of the configuration fields of the channels are enabled or not. Clicking on the button 'Synchronize clock' the present time will be sent to the PC.

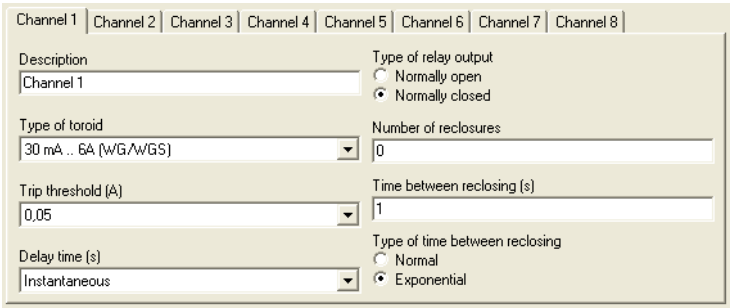


The following can be configured:

- *Type of pre-alarm relay.* Operation method of the pre-alarm relay common to all channels of the device.
- *Pre-alarm threshold.* Pre-alarm threshold the equipment possesses. This can vary between 50 and 100% of the minimum trigger threshold of the device channels.



A trigger threshold and a personalized delay time can be configured by the user. These parameters are common to all channels of the device. Depending on the type of channel selected, the customised threshold may be selected or not.



Shows the channel configuration.

As it is only possible to display the configuration of one channel at a time, click on one of the channels to display the corresponding configuration.

Alphanumeric type information where a brief description of the channel can be entered to for easy identification.

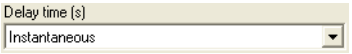
Toroid type connected to the channel. There are three possible options for selection:

- Channel disabled
- Fullscale channel with 6A (30mA .. 6A)
- Fullscale with 60A (300mA .. 60A)

Channel trigger threshold, depending on the type of toroid connected the values available will be:

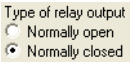
Toroid 30 mA 6… A		Toroid 300 mA 60A ...	
30 mA	1 A	300 mA	10 A
50 mA	1.5 A	500 mA	15 A
100 mA	2 A	1 A	20 A
200 mA	2.5 A	2 A	25 A
300 mA	3 A	3 A	30 A
400 mA	3.5 A	4 A	35 A
500 mA	4 A	5 A	40 A
600 mA	4.5	6 A	45 A
700 mA	5 A	7 A	50 A
800 mA	5.5 A	8 A	55 A
900 mA	6 A	9 A	60 A
Customised [1]		Customised	

[1] Only if the value of the customised trigger threshold does not exceed 6A



Channel delay time, the possible values are:

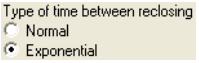
Instantaneous:	Selective	0.1 s
0.4 s	0.8 s	1 s
3 s	5 s	10 s
Customised		



Channel output relay operating mode.

Number of attempts at reclosure. After this number the relay will be latched.

Time between reclosures.

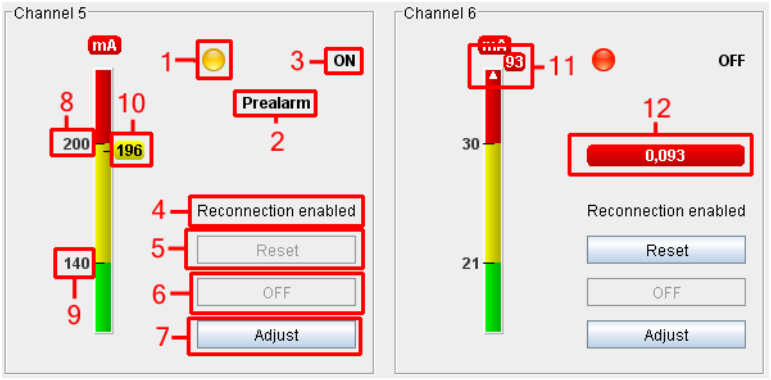


Operating mode in the time between reclosures.

3.5.2 Displaying values

The CBS-8 device will show the following value screen:

Where:



1. Channel status:

   - Status ON.
   - Pre-alarm status.
   - Status OFF.

2. Relay status:

   - ON. Non-latched channel
   - OFF. Latched channel

3. Additional information on the status of the channel:

   - *Pre-alarm:* Pre-alarm enabled
   - *Reclosure:* Channel disconnected with time reclosure process.
   - *Remote:* Channel disconnected by external triggering, cannot be automatically reconnected.

4. Reclosure enabled. Informs that the reclosures for the channel have been enabled.

5. Reset button. If the channel is not triggered, the button will remain disabled. Click on the button to reset the channel.

6. Off button. External disconnection of the channel. The button will remain disabled if the channel has not been triggered.

7. Adjustment button. Enables the sensitivity programming and channel delay. Channel information is also shown.

8. Trip threshold value configured for the channel.

9. Pre-alarm value configured for the channel.

10. Instantaneous earth leakage current value of the channel.

11. When the Instantaneous earth leakage current value of the channel exceeds the limits of the value bar, either in excess or default, this will be indicated as shown in the figure (arrow below the value)

12. Earth leakage current value detected when the channel trigger occurs.

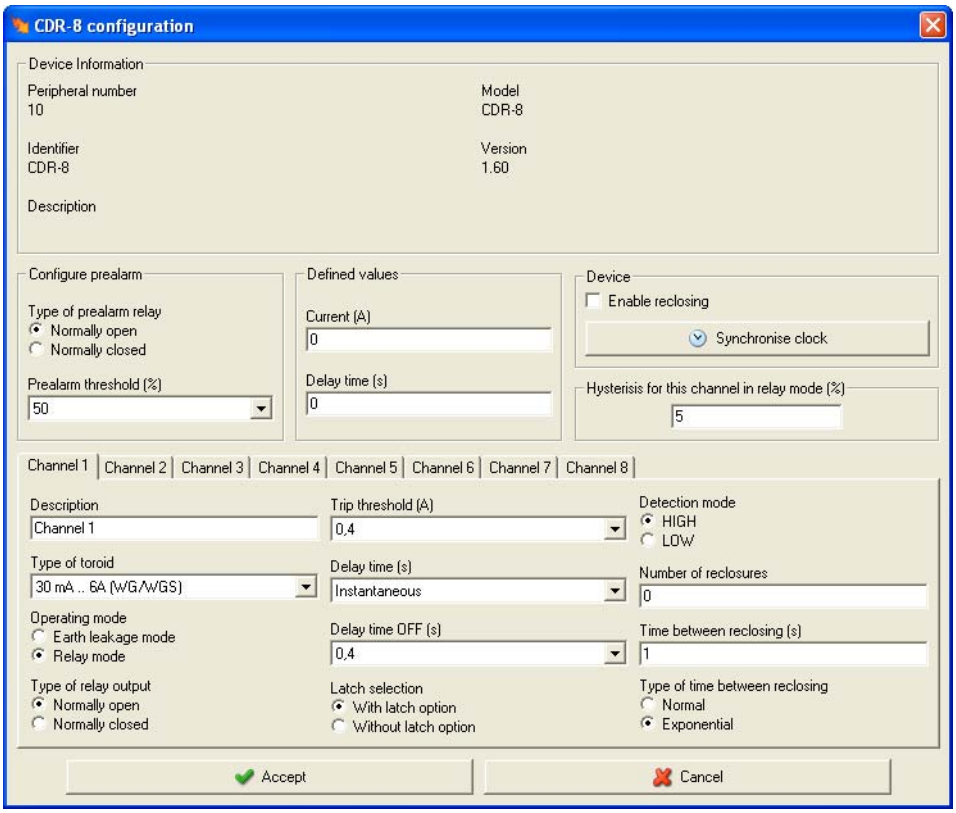
3.6 CDR-8

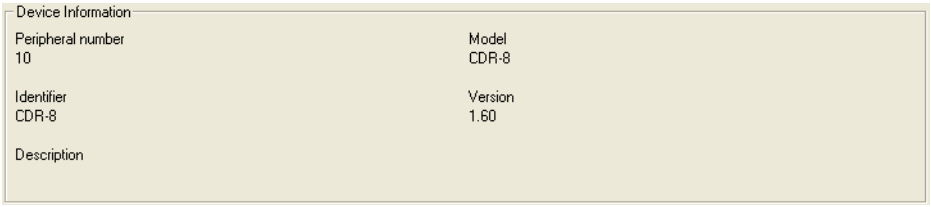
3.6.1 Driver options

The following is the options menu:

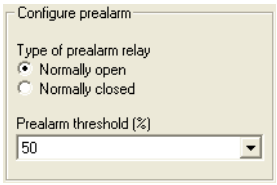
3.6.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.



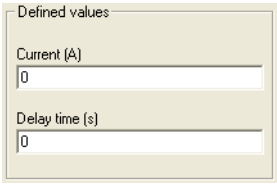


Shows general information.

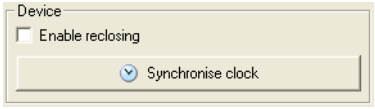


The following can be configured:

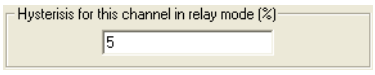
- *Type of pre-alarm relay.* Operation method of the pre-alarm relay common to all channels of the device.
- *Pre-alarm threshold.* Pre-alarm threshold the equipment possesses. This can vary between 50 and 100% of the minimum trigger threshold of the device channels.



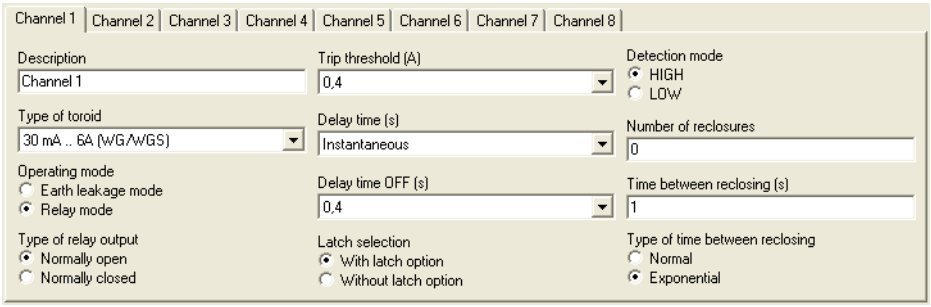
A trigger threshold and a user-personalised delay time can be configured by the user. These parameters are common to all channels of the device. Depending on the type of channel selected, the customised threshold may be selected or not.



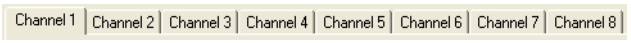
This selector allows the equipment to have the channel reclosures enabled or not. Depending on whether the reclosures are enabled or not, some of the channel configuration fields will be enabled or disabled. Clicking on the 'Synchronize clock' button the present PC time will be sent to the device.



% Of hysteresis for the connection and disconnection of the channel configured in the relay mode.



Shows the channel configuration.

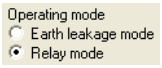


As it is only possible to display the configuration of one channel at a time, click on one of the channels to display the corresponding configuration.

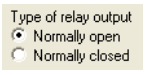
Alphanumeric type information where a brief description of the channel can be entered for easy identification.

Toroid type connected to the channel. There are three possible selection options:

- Channel disabled
- Fullscale channel of 6A (30mA .. 6A)
- Fullscale channel of 60A (300mA .. 60A)



Channel operating mode. Depending on the selected mode, some of the configuration options of the channel may be disabled.



Channel output relay operating mode.

Channel triggering threshold, depending on the type of toroid connected the available values will be:

Toroid 30 mA...6A		Toroid 300 mA 60A ...	
30 mA	1 A	300 mA	10 A
50 mA	1.5 A	500 mA	15 A
100 mA	2 A	1 A	20 A
200 mA	2.5 A	2 A	25 A
300 mA	3 A	3 A	30 A
400 mA	3.5 A	4 A	35 A
500 mA	4 A	5 A	40 A
600 mA	4.5 A	6 A	45 A
700 mA	5 A	7 A	50 A
800 mA	5.5 A	8 A	55 A
900 mA	6 A	9 A	60 A
Customised [1]		Customised	

[1] Only if the value of the customised trigger threshold does not exceed 6A

Channel delay time, depending on the selected operating mode, the possible values are:

Instantaneous:	Selective	0.1 s
0.4 s	0.8 s	1 s
3 s	5 s	10 s
60 s [1]	Customised	

[1] Only if the channel works on the relay mode

Delay time in the channel reset when working on the relay mode, the possible values are:

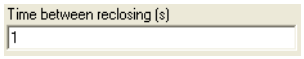
0.1 s	0.4 s	0.8 s

1 s	3 s	5 s
10 s	60 s	Customised

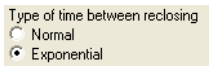
Channel latch selection when working on the relay mode.

Triggering selection; low current (LOW) or overcurrent (HIGH) of the channel when working in relay mode.

Number of attempts at reclosure. After this number the relay will be latched.



Time between reclosures.

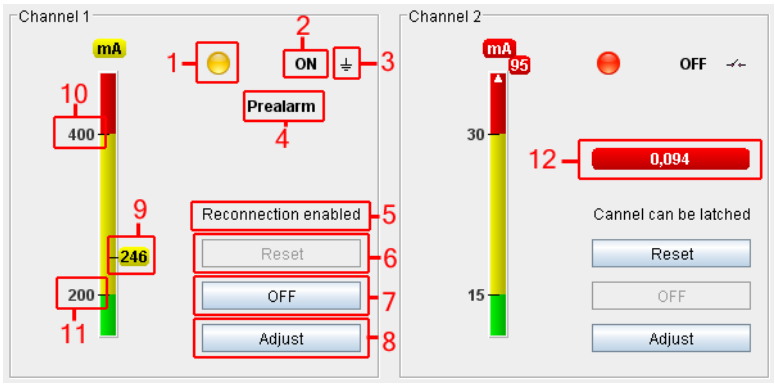


Operating mode in the time between reclosures.

3.6.2 Displaying values

The CDR-8 device will display the following screen values:

Where:



1. Channel status:
   - Status ON.
   - Pre-alarm status.
   - Status OFF.
2. Relay status:
   - ON. Channel not latched
   - OFF. Channel latched
3. Channel operating mode:
   - ⏚ Earth leakage Mode
   - ⏦ Relay mode

4. Additional information on the status of the channel:

    - *Pre-alarm:* Pre-alarm enabled
    - *Reclosure:* Channel disconnected timing in the process of reclosure.
    - *Remote:* Channel disconnected by external triggering, cannot be automatically reconnected.

5. Additional channel information:

    - *Reclosure enabled:* Informs that the reclosures for the channel have been enabled. Only if the channel operates in earth leakage mode
    - *Channel can be latched.* Reports that the channel will remain latched when triggering is produced, with manual or remote reset of said channel being necessary. Only if the channel works in the relay mode.
6. Reset button. If the channel is not triggered, the button will remain disabled. Push the button to restart the channel.

7. Off button. External disconnection of the channel. The button will remain disabled if the channel has not been triggered.

8. Adjustment button. Enables the sensitivity programming and channel delay. Also shows channel information.

9. Instantaneous earth leakage current value of the channel. When the instantaneous earth leakage current value exceeds the limits of the value bar, both above and below, this will be indicated as shown in the figure (arrow below the value).

10. Trigger threshold value configured for the channel.

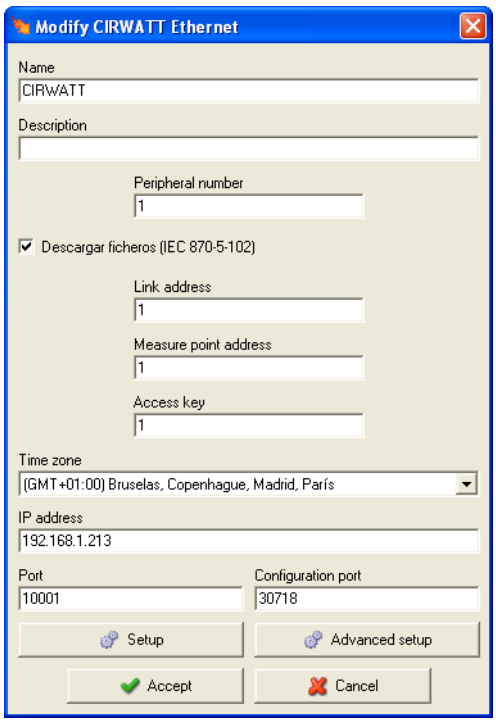
11. Pre-alarm value configured for the channel.

12. Earth leakage current value detected when the channel is triggered.

3.7 CIRWATT

3.7.1 Download with protocol IEC 870-5-102

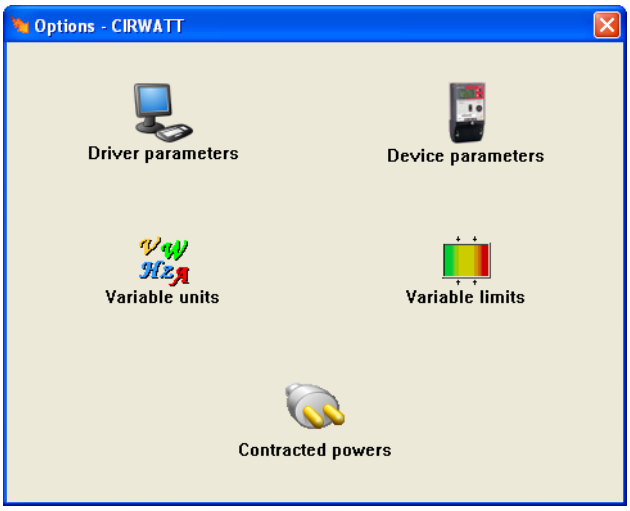
The CIRWATT device allows load curve and bill closures files to be downloaded through the IEC 870-5-102 protocol. To enable downloading when new equipment is added the "Download files (IEC 870-5-102)" option must be selected and the gateway, the measuring point address and password configured.



From this screen it is possible to configure the time zone where the CIRWATT is located, by default the time zone of the software will appear but this should be modified if a new device is found in a different time zone.

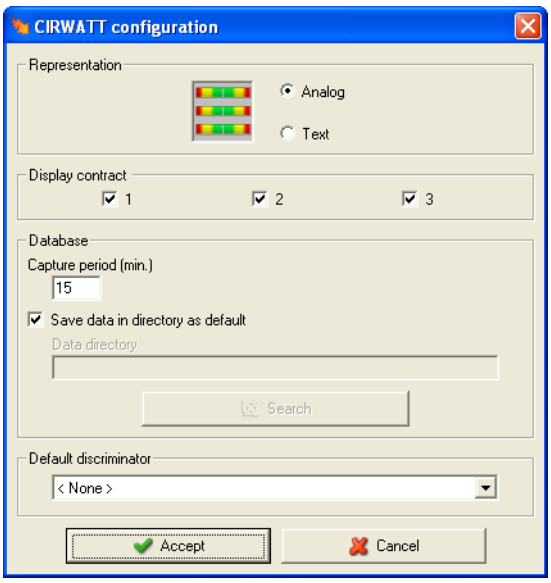
3.7.2 Driver options

The following is the options menu:



The options "Variable Units" and "Variable Limits" are detailed in 3.1.2 Variable Units and 3.1.3 Variable limits.

3.7.2.1 Driver Parameters

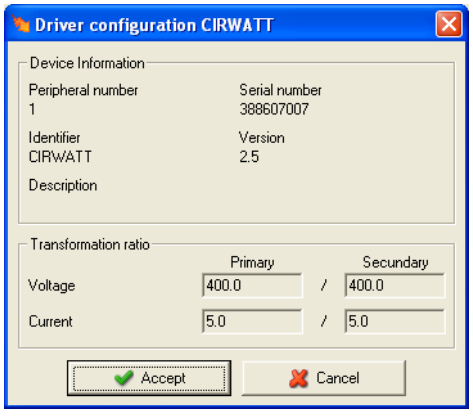


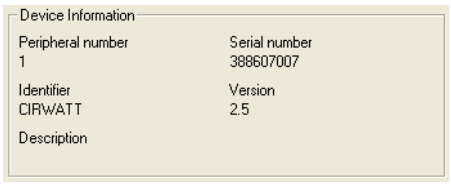
Enables the contracts to be displayed on screen. Using these selectors the contracts shown on screen can be selected. In this case the driver displays contracts 1 and 3 and will hide contract 2. These parameters will only affect the screen display of the CIRWATT device contracts but not the internal configuration of the CIRWATT device.

The remaining parameters are explained in section 3.1.1 Driver Parameters.

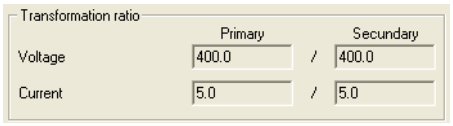
3.7.2.2 Device parameters

This screen will allow a series of internal information and parameters of the device to be displayed on screen.





Shows general information.



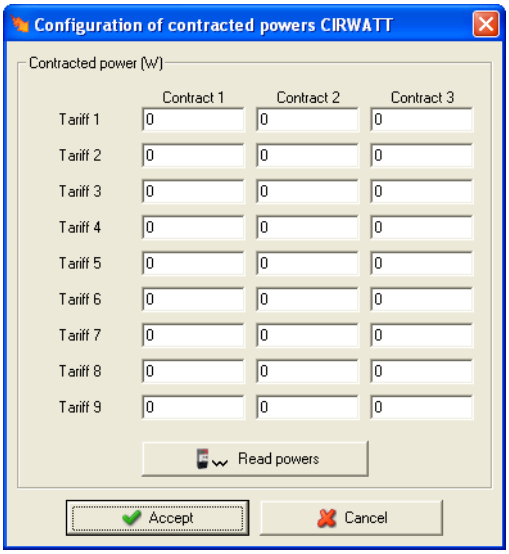
- **Voltage transformation ratio:** shows the ratio between primary and secondary voltage programmed into the device.

- **Power transformation ratio:** Shows the ratio between the current primary and secondary programmed into the device.

3.7.2.3 Contracted power

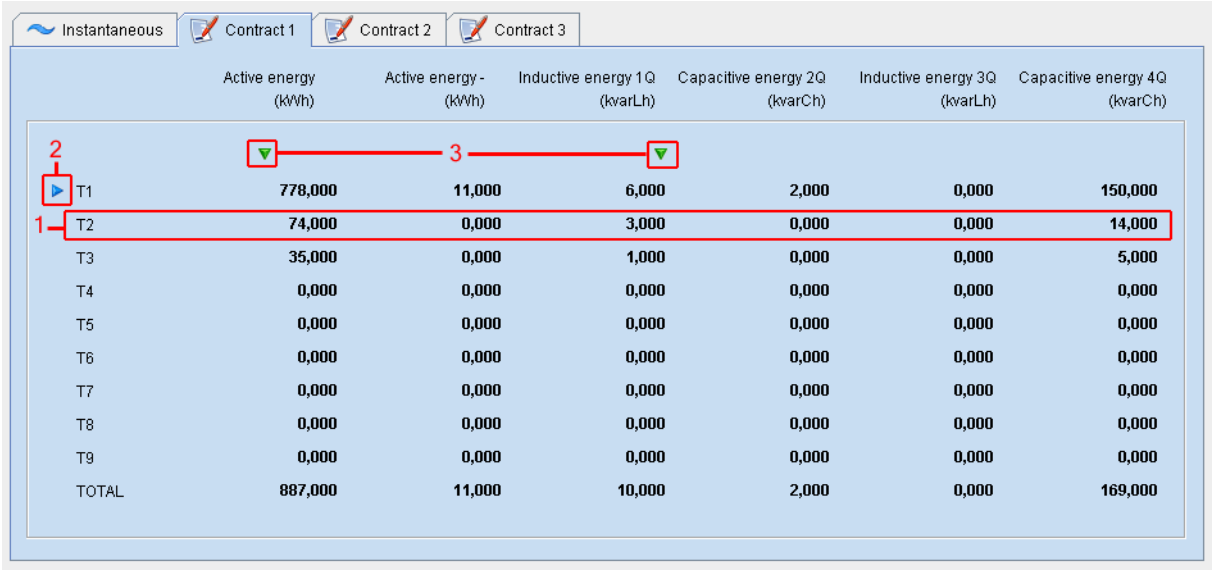
This screen allows the contracted loads for each contract and tariff of the CIRWATT to be displayed. It will always be possible to enter contracted power manually, but if the device is IEC enabled it can also be read directly from the equipment by clicking the

button;



3.7.3 Displaying Contracts

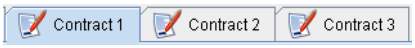
The CIRWATT device shows the following screen when viewing a contract:



	Active energy (kWh)	Active energy - (kWh)	Inductive energy 1Q (kvarLh)	Capacitive energy 2Q (kvarCh)	Inductive energy 3Q (kvarLh)	Capacitive energy 4Q (kvarCh)
T1	778,000	11,000	6,000	2,000	0,000	150,000
T2	74,000	0,000	3,000	0,000	0,000	14,000
T3	35,000	0,000	1,000	0,000	0,000	5,000
T4	0,000	0,000	0,000	0,000	0,000	0,000
T5	0,000	0,000	0,000	0,000	0,000	0,000
T6	0,000	0,000	0,000	0,000	0,000	0,000
T7	0,000	0,000	0,000	0,000	0,000	0,000
T8	0,000	0,000	0,000	0,000	0,000	0,000
T9	0,000	0,000	0,000	0,000	0,000	0,000
TOTAL	887,000	11,000	10,000	2,000	0,000	169,000

Where:

1. Corresponds to the information of a new contract rate.
2. Marks the active rate of the contract.
3. Marks the active quadrant.

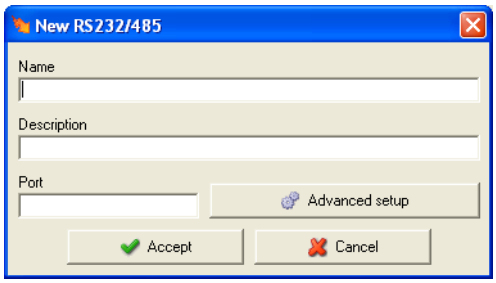


Selecting the various tabs the desired contract can be shown. As indicated in section 3.7.2.1 Driver Parameters, it is possible to select which contracts we want to view, and the tab corresponding to the hidden contracts will not appear. For example if you only want to view contracts 1 and 3 the tabs will be as follows:

3.8 Converter RS232/485

The converter RS232/485 connects equipment which works with an RS-485 serial connection to the port of the PC with an RS-232.

By adding or modifying this device, see 2.2.1.1, Adding a first-level device, the following dialogue will appear



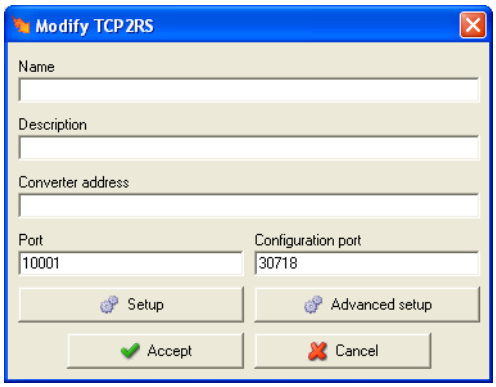
Where

- **Name:** Alphanumeric field which uniquely identifies the device throughout the program. There are no two devices in the configuration with the same name.
- **Description:** Alphanumeric type data to enter a brief description of the device.
- **Port:** Number of the serial port that the program uses for communication with the device.
- **Advanced setup:** Permits the configuration of a series of additional parameters of the device. See section 2.2.1.3 Advanced configuration of devices.

3.9 Converter TCP2RS:

The TCP2RS connects equipments which works with serial communication (RS-232 / RS-485) to an Ethernet network using the IP protocol

On adding or modifying this device, see 2.2.1.1. Adding a first-level device, the following dialogue will appear



Where

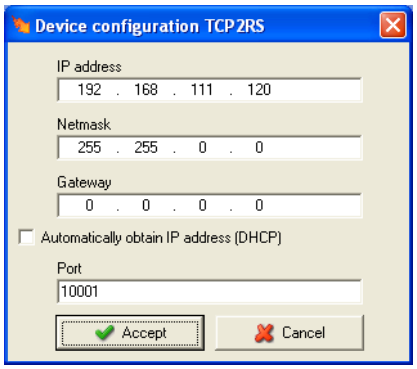
- **Name:** Alphanumeric field which uniquely identifies the device throughout the program. There are no two devices in the configuration with the same name.
- **Description:** Alphanumeric type data to enter a brief description of the device.
- **Converter address:** Corresponds to the address through which the program can communicate with the device. This parameter can be an IP address or a name. This direction should not be confused with the MAC address.
- **Port:** Corresponds to the converter communications port:
- **Configuration port:** Corresponds to the communication port, through which the program can configure the device. This port is 30718 by default.

For a TCP2RS device to be able to communicate through a router carry out the following steps:

1-In the "*Converter Address*" field enter the IP address of the router.
2-In the "*Port*" field enter the communications port and redirect this port on the router to the communications port of the device.
3 - Redirect the configuration port on the router to port 30718 of the converter.

N.b.: For information on re-addressing ports consult the router user manual.

- **Parameters:** By clicking the button a dialogue will appear where a number of parameters of the device can be configured.

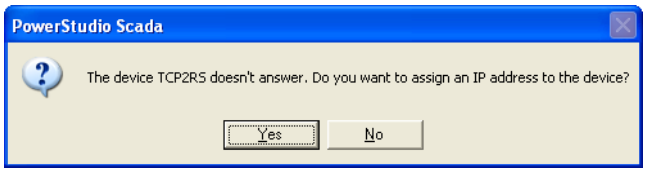


Where:

- *IP address:* Corresponds to the IP address through which we can communicate with the device.
- *Subnet Mask:* Corresponds to the subnet mask used on the network where the device is connected
- *Predetermined Gateway:* Corresponds to the address of the gateway if the device is not on the same network as the computer containing the program.
- *Obtain an IP address automatically (DHCP):* This option will be enabled when we want the device to automatically receive the IP address via a DHCP server.
- *Port:* Corresponds to the communications port of the device.

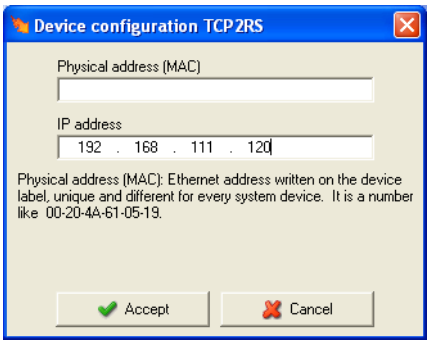
- **Advanced communication:** Permits the configuration of a series of additional parameters of the device. See section 2.2.1.3 Advanced configuration of devices.

On adding or modifying the device, the software will try to detect it. If it is unable to detect it, if the device is new or has not been allocated an IP address or has an allocated an IP different to that entered in the *'Converter Address*"), it will ask if we want to assign a new IP address to the converter.



It will only be possible to assign an IP address to the device on the same network as the computer running the program.

If the answer *'yes'*, the following dialogue box will appear, which will permit an IP address to be assigned to the device.

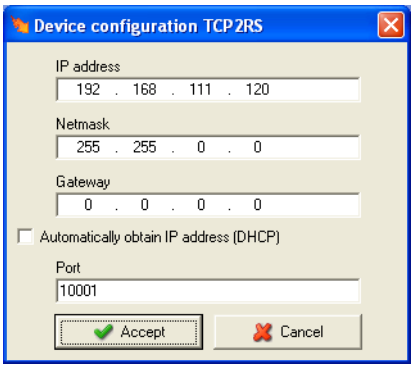


Where:

- **Physical address (MAC):** Ethernet address that each device has, which is unique and distinct on all network devices. The hardware addresses which each network interfaces possess will be type 00-20-4A-61-05-19.

- **IP address:** IP Address to be allocated to the device that has the physical address entered in the previous field.

If it is possible to assign an IP address to the converter, the following dialogue box will appear:

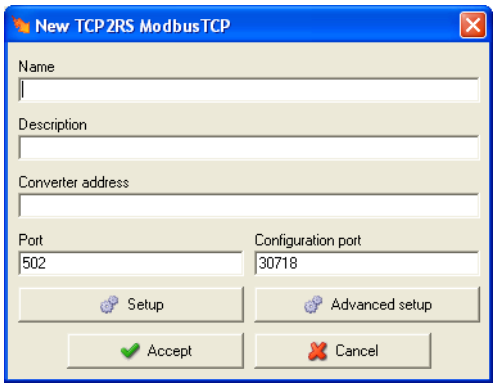


To finish setting up the rest of the parameters for communication with the device.

3.10 Converter TCP2RS ModbusTCP

The TCP2RS converter connects equipment which works with serial communication (RS-232 / RS-485) to an Ethernet network using the IP protocol (ModbusTCP for connection–oriented communications).

On adding or modifying this device, see 2.2.1.1 Adding a first-level device, the following dialogue will appear



Where

- **Name:** Alphanumeric field which uniquely identifies the device throughout the program. There are no two devices in the configuration with the same name.
- **Description:** Alphanumeric type data to enter a brief description of the device.
- **Converter address:** Corresponds to the address through which the program can communicate with the device. This parameter can be an IP address or a name. This direction should not be confused with the MAC address.
- **Port:** Corresponds to the communications port: By default the Modbus TCP protocol will communicate through port 502.
- **Configuration port:** Corresponds to the communication port, through which the program can configure the device. This port is 30718 by default.

Unlike TCP2RS devices, the program does not configure any Modbus TCP device parameters automatically, using the configuration port only to detect and verify that the device configuration is correct. To configure or assign an IP address to Modbus TCP devices, consult the device manual.

To communicate a TCP2RS device through a router carry out the following steps:

1–In the “Converter Address” field, enter the IP router address.
2–In the “Port” field enter the communications port and redirect this port on the router to the communications device.
3 – Redirect the configuration port on the router to port 30718 of the converter.

N.B.: For information on re-addressing ports consult the user manual.

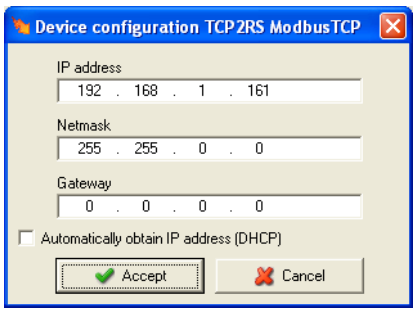
There are some second-tier devices that when connecting to a Modbus TCP device require manual configuration, the communication is limited to the mere display, for Modbus TCP these devices cannot be configured. Devices of this nature are:

- CVM – B / BD

- CVMK
- CVMK – HAR

The special characteristics, as well as the pertinent configuration to carry out correct Modbus TCP connection are specified in the corresponding sections of each device.

- **Parameters:** By clicking the button a dialogue will appear where a number of parameters of the device can be configured.

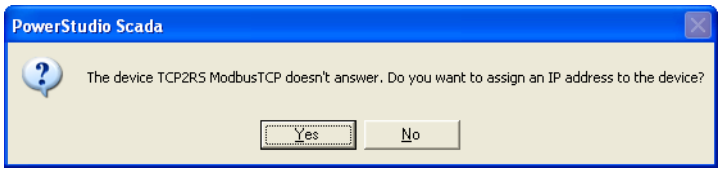


Where:

- *IP address:* Corresponds to the IP address through which we can communicate with the device.
- *Subnet Mask:* Corresponds to the subnet mask used on the network where the device is connected
- *Predetermined Gateway:* Corresponds to the address of the gateway in the case that the device is not on the same network as the computer containing the program.
- *Obtaining an IP address automatically (DHCP):* This option will be enabled when we want the device to automatically receive the IP address via a DHCP server.

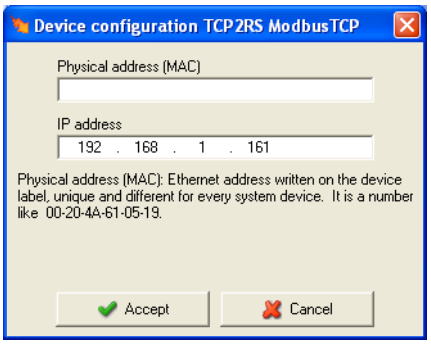
- **Advanced communication:** Permits the configuration of a series of additional parameters of the device. See section 2.2.1.3 Advanced configuration of devices.

On adding or modifying the device, the software will try to detect it. If it is unable to detect it, if the device is new or has not been allocated an IP address or has an allocated IP different to that entered in the *'Converter Address'*, it will ask if you want to assign a new IP address to the converter.



It will only be possible to assign an IP address to the device if is on the same network as the computer running the program.

If the answer is *'yes'*, the following dialogue box will appear, which will permit an IP address to be assigned to the device.

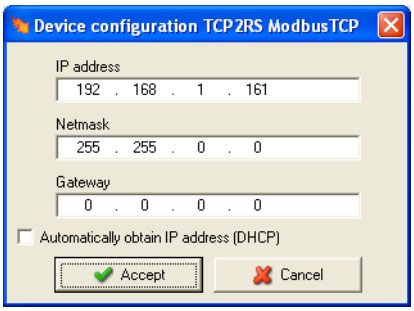


Where:

- **Physical address (MAC):** Ethernet address that each device has, which is unique and distinct on all network devices. The hardware addresses which network interfaces possess, this will be type 00-20-4A-61-05-19.

- **IP address:** IP Address to be allocated to the device that has the physical address introduced in the previous field.

If it is possible to assign an IP address to the converter, the following dialogue box will appear:



to finish setting up the rest of the parameters for communication with the device.

3.11 Converter TCP2RS QNA RS485

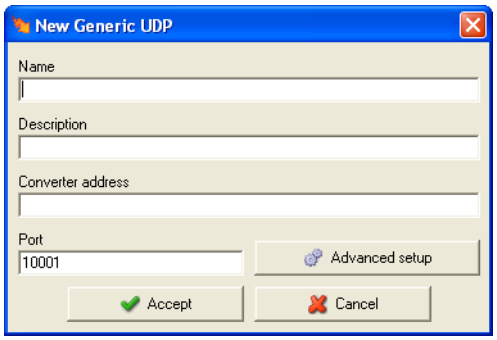
The converter TCP2RS QNA RS485 connects QNA devices which work with serial communications RS-485 on an Ethernet network using IP protocol.

Due to the peculiarities of the communication with QNA devices, only QNA-412 and QNA-413 second-level devices will be able to be connected to TCP2RS QNA RS485 first-level devices.

For more information on how to add and configure this device see section 3.9 TCP2RS converter.

3.12 General UDP Converter

The generic UDP converter connects devices that use serial communications (RS-232/RS-485) to an Ethernet network using the IP protocol (UDP for datagram communications).



Where

- **Name:** Alphanumeric field which uniquely identifies the device throughout the program. There are no two devices in the configuration with the same name.
- **Description:** Alphanumeric type data to enter a brief description of the device.
- **Converter address:** Corresponds to the address through which the program can communicate with the device. This parameter can be an IP address or a name. This direction should not be confused with the MAC address.
- **Port:** Corresponds to the communications port:
- **Advanced communication:** Permits the configuration of a series of additional parameters on the device. See 2.2.1.3 Advanced configuration of devices.

Due to the large number of converters that can be found on the market. On adding this device the program the programme will not attempt to detect or verify that the configuration is correct.

The configuration and the proper functioning of communications between the converter and the program is the responsibility of user.

For more information on how to configure the converter consult the device manual.

3.13 Generic TCP converter

The generic TCP converter connects devices that work with serial communication (RS-232/RS-485) to an Ethernet network using the IP protocol (TCP for connection-oriented communications).

Due to the large number of converters that can be found on the market. On adding this device the program will not attempt to detect or verify that the configuration is correct.

The configuration and the proper functioning of communications between the converter and the program is the responsibility of the user.

For more information on how to configure the converter consult the device manual .

For more information on how to configure this converter see section 3.12 UDP Generic Converter.

3.14 ModbusTCP generic Converter

The ModbusTCP generic converter connects devices that work with serial communication (RS-232/RS-485) to an Ethernet network using the IP protocol (ModbusTCP for connection orientated communications).

Due to the large number of converters that can be found on the market. On adding this device the program will not attempt to detect or verify that the configuration is correct.

The configuration and the proper functioning of communications between the converter and the program is the responsibility of user.

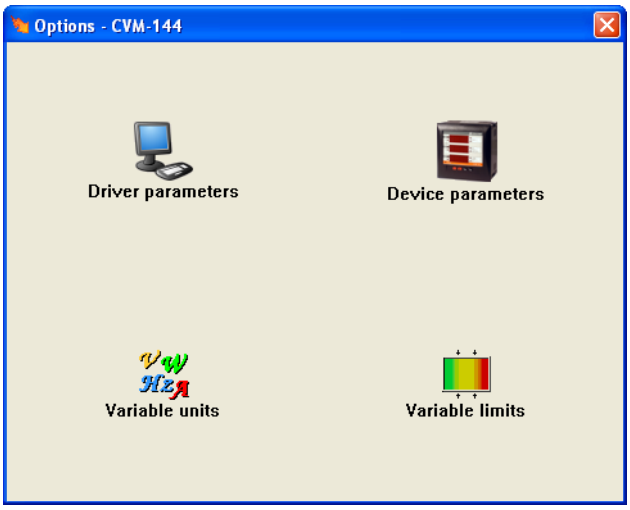
For more information on how to configure the converter consult the device manual.

For more information on how to configure this converter see section 3.12 Generic UDP Converter.

3.15 CVM-144

3.15.1 Driver options

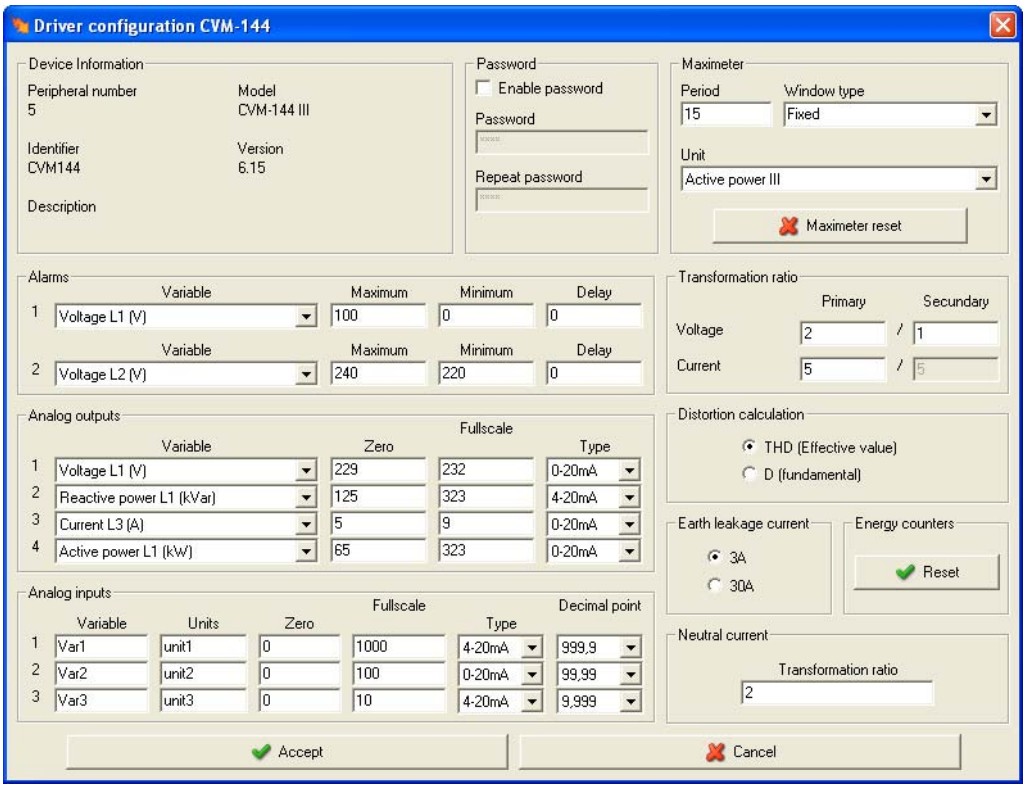
The following is the options menu:



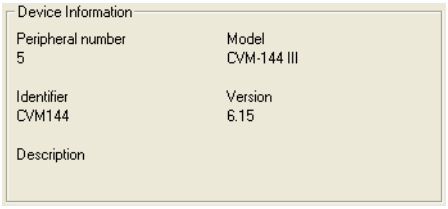
The options "Variable Units" and "Variable Limits" are detailed in 3.1.2 Variable units and 3.1.3 Variable limits.

3.15.1.1 Device parameters

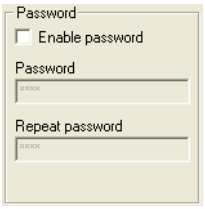
This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.



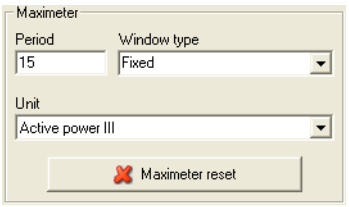
Depending on the device connected, some of the fields can be disabled.



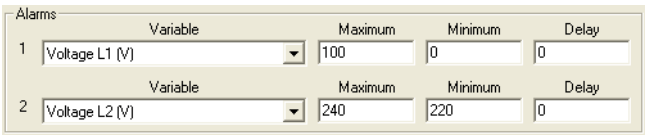
Shows general information.



Allows the password to be enabled or disabled to lock the keyboard configuration of the device.

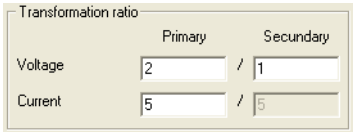


- **Period:** Is the integration period of the maximeter that can oscillate between 1 and 60 minutes.
- **Type of window:** Type of window used to save the maximeter value, this can be fixed or sliding.
- **Unit:** The maximum demand can be calculated with active power III, apparent power III current III or current by phase depending on the device.
- **Maximeter reset:** Clicking on this button sends the device maximeter to zero.



This section shows the configuration of the relay outputs of the device and the option is given to configure them with the required values.

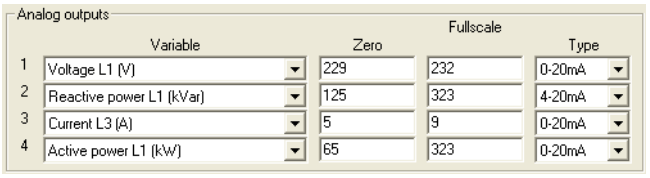
- **Variable:** The parameters associated with the relay are indicated in this field. The output is programmed as an alarm, allowing any of the parameters measured by the CVM-144 to be controlled. The units in which the maximum and minimum values of the alarm are expressed are in brackets.
- **Max:** In this box the maximum value to control is indicated.
- **Min:** In this box the minimum value to control is indicated.
- **Delay:** Delay in seconds of the alarm. The maximum value is 9999 seconds.



- **Voltage transformation ratio:** Primary and secondary voltage programming. The product value between primary value and primary current has to be equal or less than 20,000,000. The primary value, depending on the fullscale, must be between 1 and the corresponding value of the following table:

Fullscale background:	Maximum value.
110v	99.999
275v	70.000
300v	70.000
500V	40.000

- **Current transformation ratio:** This is the primary current value the device has. The value can be between 1 and 10,000 A. The secondary current is 5A in the CVM-144.



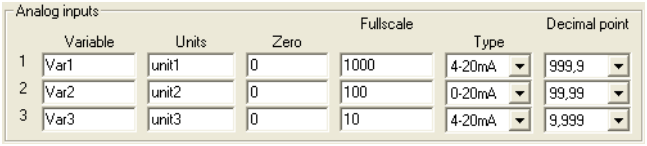
This section shows the configuration of the analogue outputs of the device and the option is given to configure them with the desired values.

- **Variable:** Permits any parameter measured by the CVM-144 to be selected, except parameters corresponding to energy.

- **Zero:** Value of the parameter to which the zero of the scale is assigned.

- **Fullscale:** Value of the parameter to which the maximum value of the scale is assigned.

- **Type:** Output type, allows outputs 0 – 20 mA, 4 – 20 mA or 0 – 10 V to be chosen, depending on the device.



- **Variable:** This indicates the name associated with the analogue input.

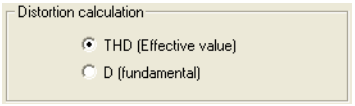
- **Units:** This indicates the type of units the variable represents.

- **Zero:** Value of the parameter to which the zero of the scale is assigned.

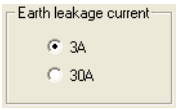
- **Full scale:** Value of the parameter to which the maximum value of the scale is assigned.

- **Type** Input type, allows input 0 – 20 mA, 4 – 20 mA or 0 – 10V V to be chosen, depending on the device.

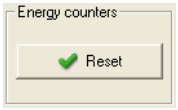
- **Decimal point:** Position of the decimal point. Only if the device allows us to display the analogue inputs with real measurement values.



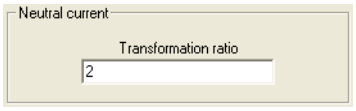
Using this selector the type of distortion that the device will calculate can be configured.



Using this, the leakage current of the device can be configured. Only for those devices that can measure leakage current.



On clicking the button the energy counters on the device will return to zero.

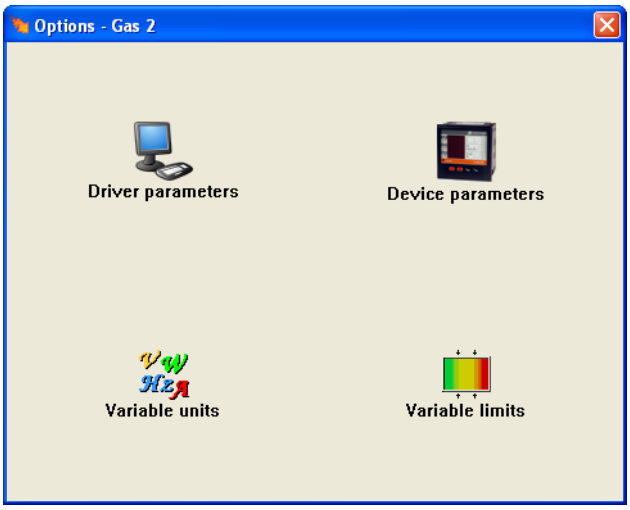


Configuration of the transformation ratio of the neutral current. Only for those devices that can measure leakage current.

3.16 CVM-96

3.16.1 Driver options

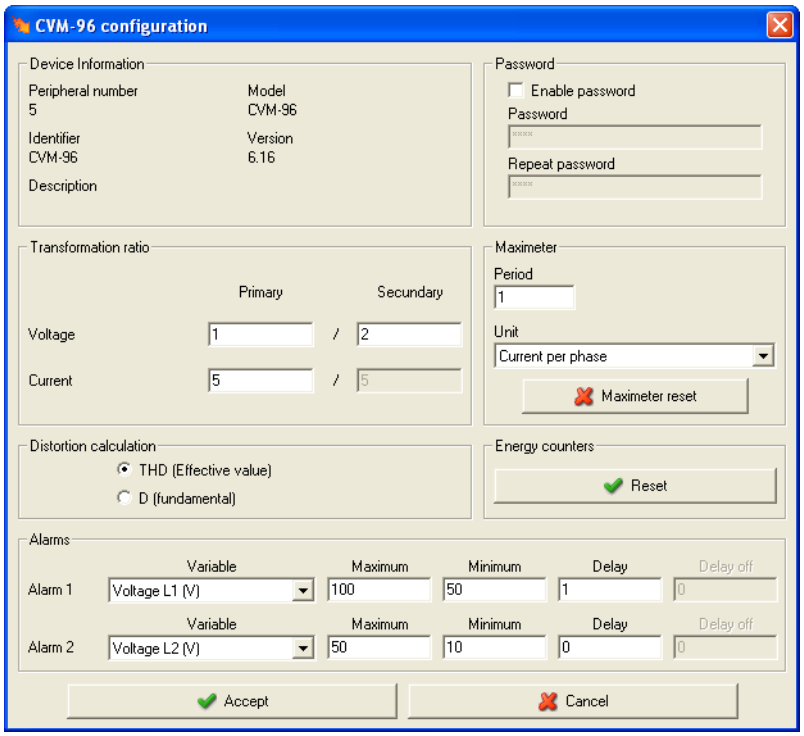
The following is the options menu:

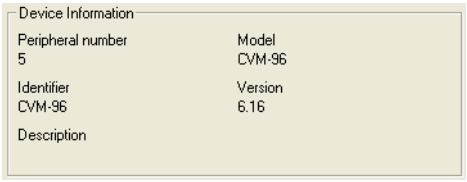


The options "Variable Units" and "Variable Limits" are detailed in 3.1.2 Variable units and 3.1.3 Variable limits.

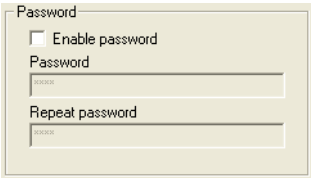
3.16.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

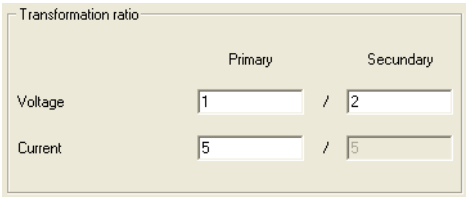




Shows general information.



Enables the password to be enabled or deactivated to block the configuration of the device by the keyboard.

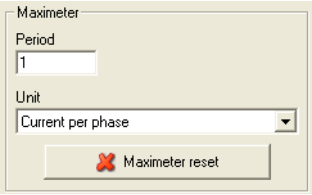


Depending on the version connected, programming of the voltage transformation ratio can be disabled.

- **Voltage transformation ratio:** Primary and secondary voltage programming. The product between the primary value and primary current has to be equal or less than 20,000,000. The value of the primary, depending on the full scale of the equipment, must be between 1 and the value of the following table:

Fullscale background:	Maximum value.
110v	99.999
275v	70.000
300v	70.000
500V	40.000

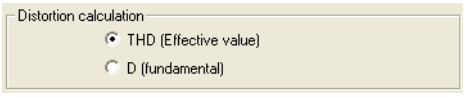
- **Current transformation ratio:** This is the primary current value the device has. The value can be between 1 and 10,000 A. The secondary current is 5A on the CVM-96.



- **Period:** Is the integration period of the maximeter that can oscillate between 1 and 60 minutes.

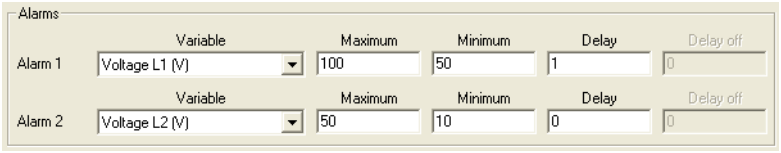
- **Unit:** The maximum demand can be calculated with active power III, apparent power III, current III or phase current depending on the device.

- **Maximeter reset:** When the button is enabled, the device maximeter goes to zero.



Using this selector the type of distortion can be configured that the device will calculate.

On clicking the button the energy counters on the device will return to zero.



This section shows the configuration of the relay outputs of the device and the option is given to configure them with the desired values.

- **Variable:** The parameters associated with the relay are indicated in this field. The output is programmed as an alarm, and can control any of the parameters measured by the CVM-96. The brackets show the units used to express the maximum and minimum values of the alarm.

- **Max:** In this box the maximum value to control is indicated.

- **Min:** In this box the minimum value to control is indicated.

- **Delay:** Alarm delay in seconds. The maximum value is 9999 seconds.

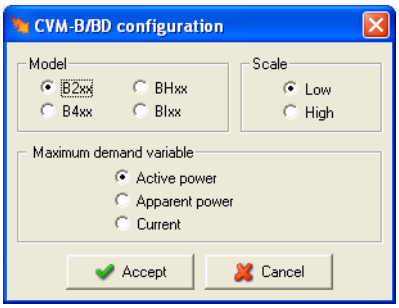
3.17 CVM-B/BD

3.17.1 Connection with Modbus TCP

The CVM-B/BD devices can connect on MODBUSTCP connections with some limitations. PowerStudio can read the values measured by the device but cannot read the configuration. Although it is not possible to read the configuration, for the correct visualisation of values, PowerStudio needs to know certain information about the device. This information should be entered by the user, and it will be the responsibility of the user to ensure that the data corresponds to the device connected. If this data introduced by the user were incorrect it could give communication errors making it impossible for PowerStudio to show the values measured by the device.

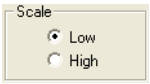
On adding a device on an MODBUSTCP connection, see section 3.10 TCP2RS Modbus TCP Converter, PowerStudio will display the following warning:

Then a dialogue box will appear with the information PowerStudio needs to communicate with the device.

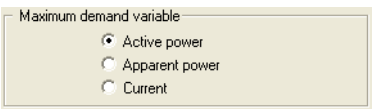


The user must select the correct information corresponding to the device connected.

Device model. Using the model, PowerStudio can ascertain which variables are measured by the device thus avoiding variables not possessed by the device being asked for.



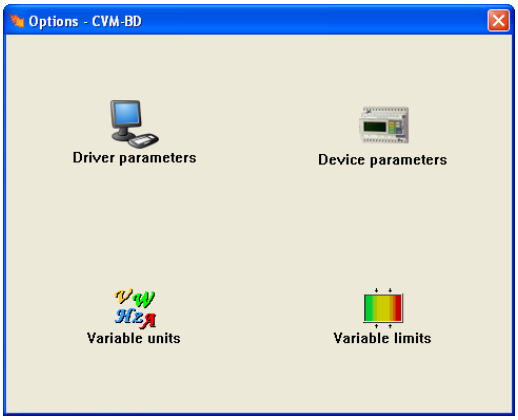
Measurement scale of the variables. This will be used by PowerStudio for the correct visualisation of the values shown on screen



Variable used to calculate the maximum demand.

3.17.2 Driver options

The following is the options menu:

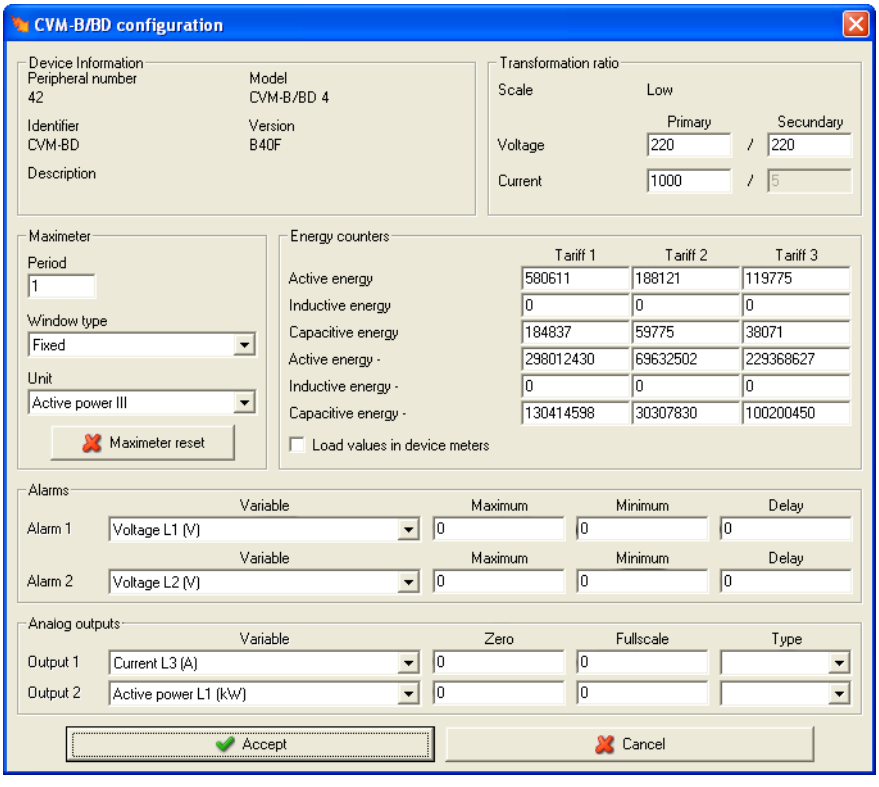


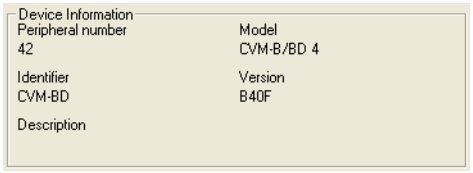
The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits.

3.17.2.1 Device parameters

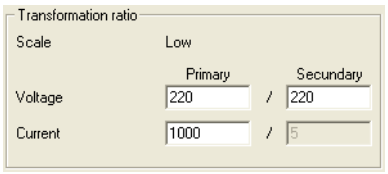
> It is not possible to configure the device when it communicated via the MODBUSTCP connection.

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.



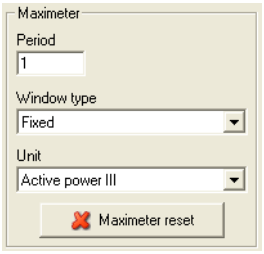


Shows general information.



- **Voltage transformation ratio:** Primary and secondary voltage programming. The primary voltage value should be between 1 and 500000 V and the secondary between 1 and 999. In addition the primary divided by the secondary must be less than 9090.

- **Primary of the current transformer:** This is the primary current value the device has. It can value between 1 and 10000 A. The secondary current is 5A in the CVM-K.

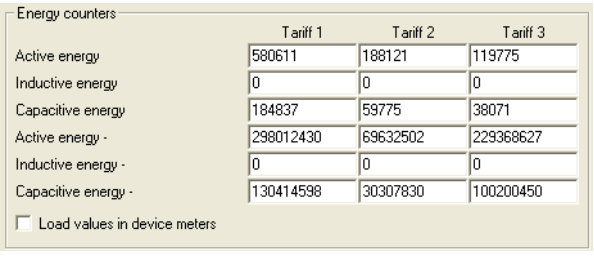


- **Period:** Is the integration period of the maximeter that can oscillate between 1 and 60 minutes.

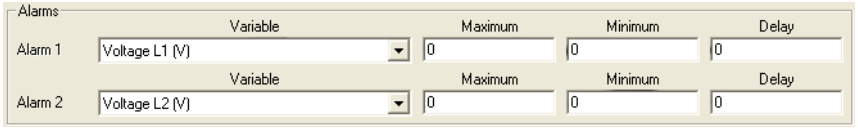
- **Type of window:** Type of window used to save the maximeter value, it can be fixed or sliding.

- **Unit** The maximum demand can be calculated with active power III, apparent power III, or current III.

- **Maximeter reset:** When the button is enabled, the device maximeter goes to zero.



This part of the configuration corresponds to device energies. Depending on the type of device some or all of the fields can be deactivated. If the selector , is checked, on sending the configuration the energy counter will be loaded with the values entered into the corresponding boxes.



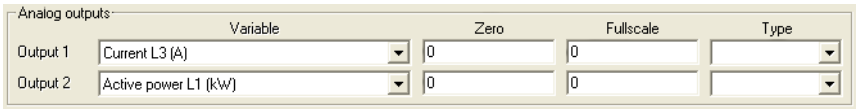
Depending on the device connected, if this has relay outputs, they can be configured with the values desired.

- **Variable:** Parameter associated to the output relay. The output is programmed as an alarm, allowing control on any of the parameters measured by the CVM-B/BD. The units in which the maximum and minimum values of the alarm are expressed are indicated in brackets.

- **Max:** In this box the maximum value to control is indicated.

- **Min:** In this box the minimum value to control is indicated.

- **Delay:** Alarm delay in seconds. The maximum value is 9999 seconds.



Depending on the device connected, if it has analogue outputs, the desired values can be configured.

- **Variable:** Parameter associated to the analogue output. Any parameter measured by the CVM-B/BD can be selected as an analogue output.

- **Zero:** Value of the parameter to which the zero of the scale is assigned.

- **Fullscale:** Value of the parameter to which maximum value of the scale is assigned.

- **Type** of input, permits either 0-20 mA or 4-20 mA to be chosen.

3.18 CVM-BC

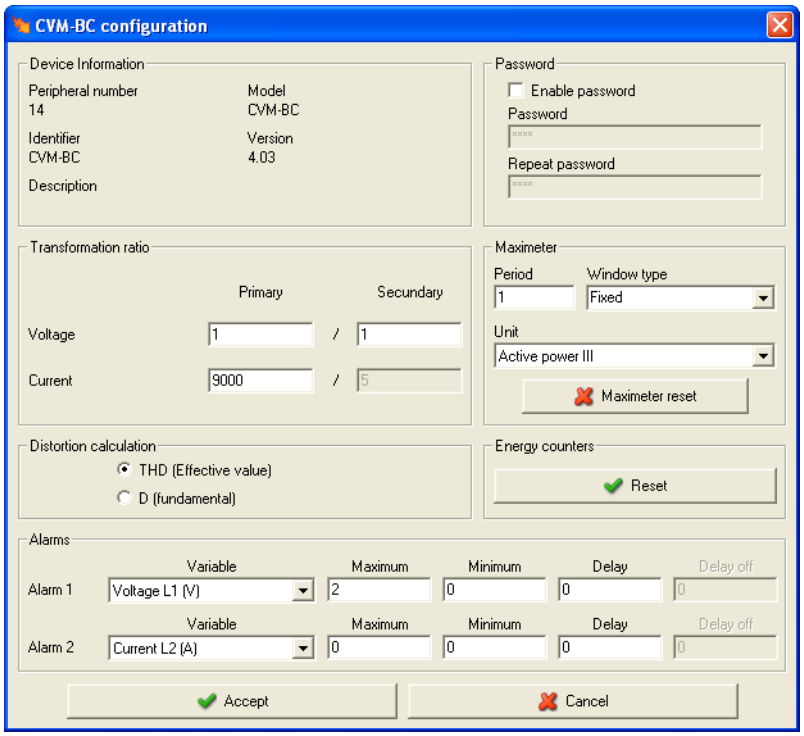
3.18.1 Driver options

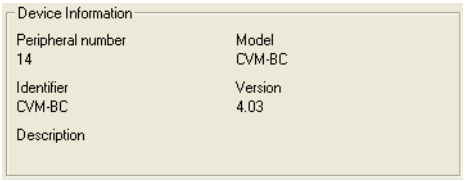
The following is the options menu:

The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits.

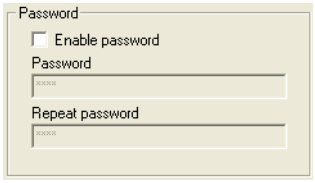
3.18.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

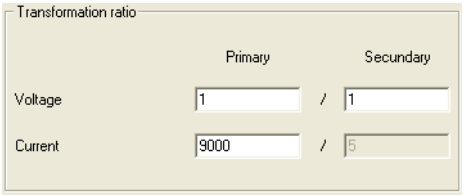




Shows general information.



Enables the password to be enabled or deactivated to block the configuration of the device by means of the keyboard.

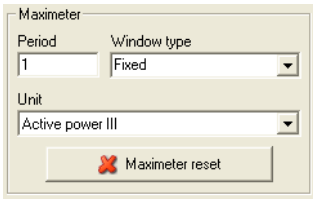


Depending on the version connected, programming of the voltage transformation ratio can be disabled.

- **Voltage transformation ratio:** Primary and secondary voltage programming. The product value between primary value and primary current has to be equal or less than 20,000,000. The primary value, depending on fullscale, must be between 1 and the value of the following table:

Full-scale :	Maximum value.
110v	99.999
275v	70.000
300v	70.000
500V	40.000

- **Current transformation ratio:** This is the primary current value the device possesses. The value can be between 1 and 10,000 A. The secondary current is 5A in the CVM-BC.

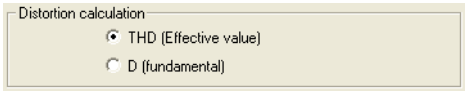


- **Period:** Is the integration period of the maximeter that can oscillate between 1 and 60 minutes.

- **Type of window:** Type of window used to store the maximeter value, it can be fixed or sliding.

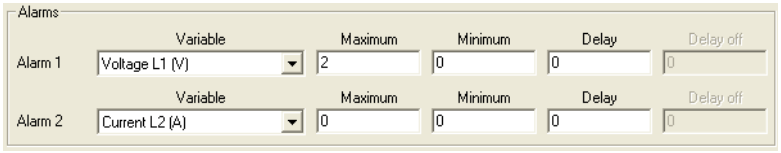
- **Unit** The maximum demand can be calculated with active power III, apparent power III, current III or phase current depending on the device.

- **Maximeter reset:** When the button is clicked, the device maximeter goes to zero.



Using this selector the type of distortion that the device will calculate can be configured.

On clicking the button the energy counters on the device will return to zero.



This section shows the configuration of the relay outputs of the device, configuration is possible with the required values.

- **Variable:** The parameters associated with the relay are indicated in this field. The output is programmed as an alarm and any of the parameters measured by the CVM-BC can be controlled. The units in which the maximum and minimum values of the alarm are expressed are indicated in brackets.

- **Max:** This box indicates the maximum value to control.

- **Min:** This box indicates the minimum value to control.

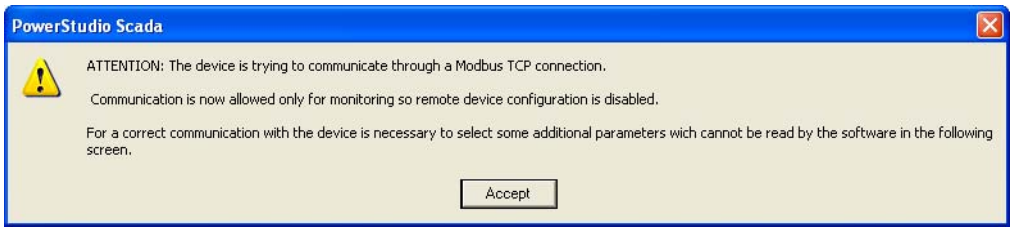
- **Delay:** Alarm delay in seconds. The maximum value is 9999 seconds.

3.19 CVM-K

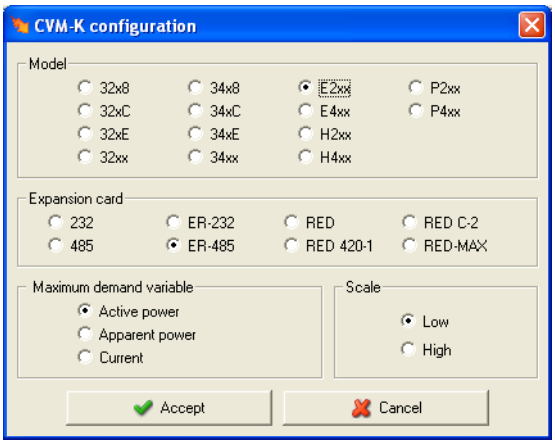
3.19.1 Connection with Modbus TCP

The CVM-K devices can connect on MODBUSTCP connections with some limitations. PowerStudio can read the values measured by the device but cannot read the configuration. Although it is not possible to read the configuration, for the correct visualisation of values, PowerStudio needs to ascertain certain information about the device. This information should be entered by the user, and it will be the responsibility of the user to ensure that the data corresponds to the device connected. If this data introduced by the user is incorrect this can give communication errors making it impossible for PowerStudio to show the values measured by the device.

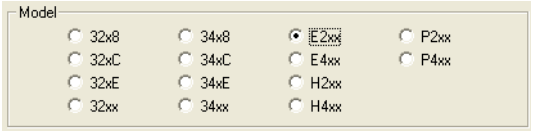
On adding a device to the MODBUSTCP connection, see section 3.10 , PowerStudio will show the following warning message.



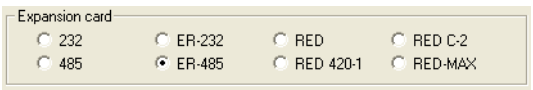
Then a dialogue box will appear with the information the PowerStudio needs to communicate with the device.



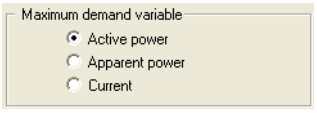
The user must select the correct information corresponding to the device connected.



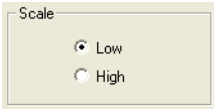
Device model. Using the model, PowerStudio can ascertain which variables are measured by the device thus avoiding variables not possessed by the device being asked for.



Expansion card.



Variable used to calculate the maximum demand.



Measurement scale of the variables. This will be used by PowerStudio for the correct visualisation of the values shown on screen

3.19.2 Driver options

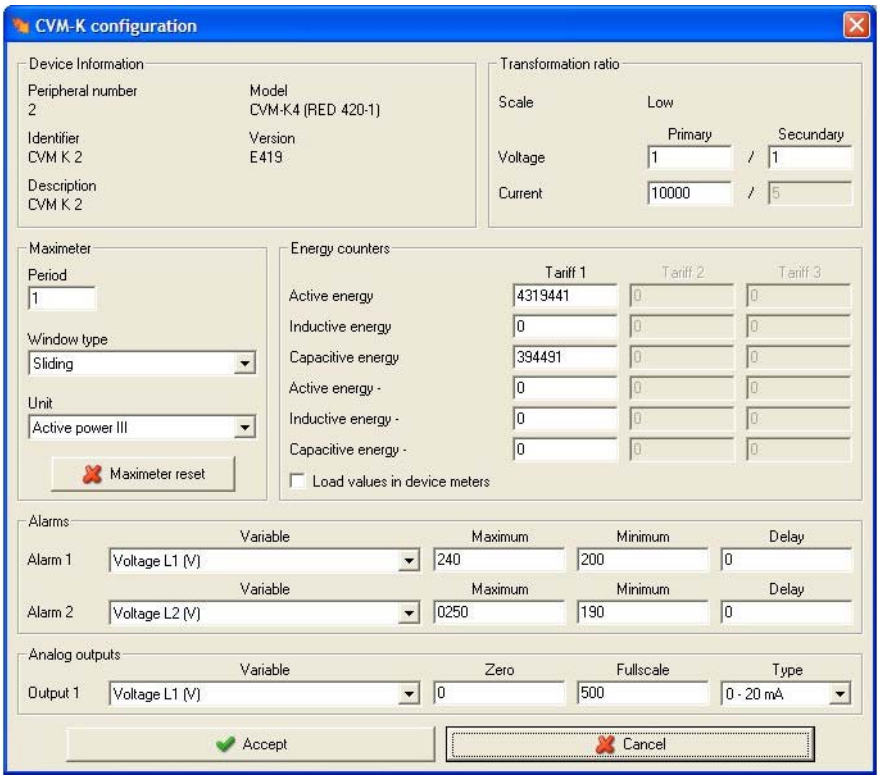
The following is the options menu:

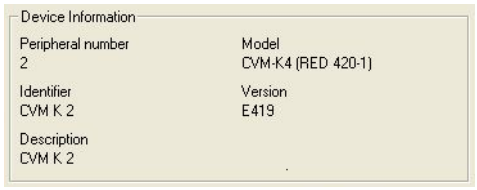
The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits.

3.19.2.1 Device parameters

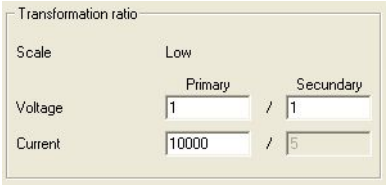
It is not possible to configure the device when it communicates via the MODBUSTCP connection.

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.



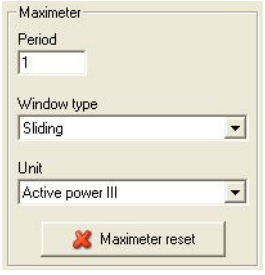


Shows general information.



- **Voltage transformation ratio:** Primary and secondary voltage programming. The value of the primary voltage should be between 1 and 500000 V and the secondary between 1 and 999 V. In addition the primary divided by the secondary must be less than 9090.

- **Primary of the current transformer:** This is the primary current value the device has. The value can be between 1 and 10,000 A. The secondary current is 5A in the CVM-K.

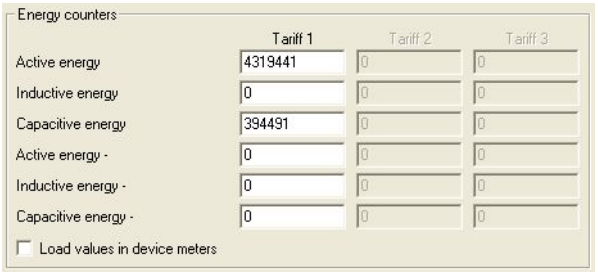


- **Period:** Is the integration period of the maximeter that can oscillate between 1 and 60 minutes.

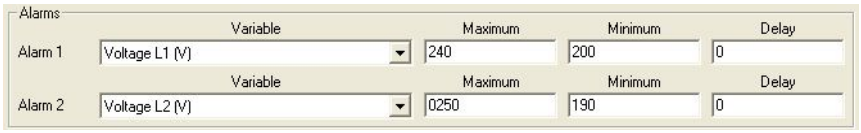
- **Type of window:** Type of window used to save the maximeter value, it can be fixed or sliding.

- **Unit** The maximum demand can be calculated with active power III, apparent power III or current III.

- **Maximeter reset:** When the button is enabled, the device maximeter goes to zero.



This part of the configuration corresponds to device energy. Depending on the type of device some or all of the fields can be deactivated. If the selector ☑, is checked, on sending the configuration the energy counter will be loaded with the values entered into the corresponding boxes.



Depending on the device connected, if this has relay outputs, they can be configured with the values desired.

- **Variable:** Parameter associated to the output relay. The output is programmed as an alarm, controlling any of the parameters measured by the CVM-K. The units in which the maximum and minimum values of the alarm are expressed are indicated in brackets.

- **Max:** The maximum value to control is indicated in this box.

- **Min:** The minimum value to control is indicated in this box.

- **Delay:** Alarm delay in seconds. The maximum value is 9999 seconds.

Depending on the device connected, if this has an analogue output, the desired values can be configured.

- **Variable:** Parameter associated to the analogue output. Any parameter measured by the CVM-K can be selected as an analogue output.

- **Zero:** Value of the parameter to which the zero of the scale is assigned.

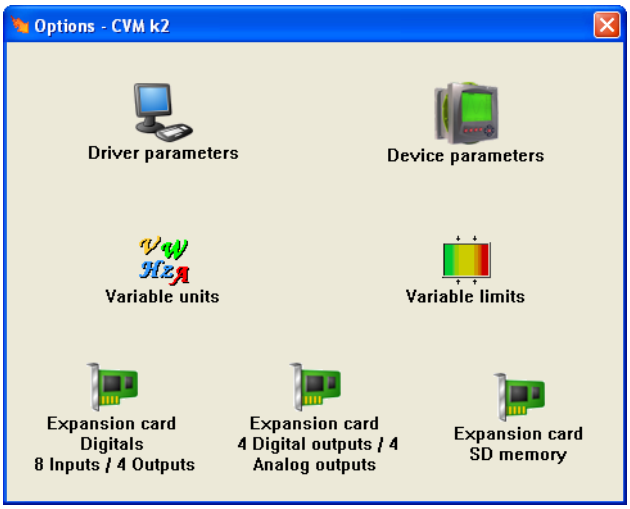
- **Full Scale:** Value of the parameter to which the maximum value of the scale is assigned.

- **Type:** Type of input, permits either 0-20 mA or 4-20 mA to be chosen.

3.20 CVM-K2

3.20.1 Driver options

The following is the options menu:



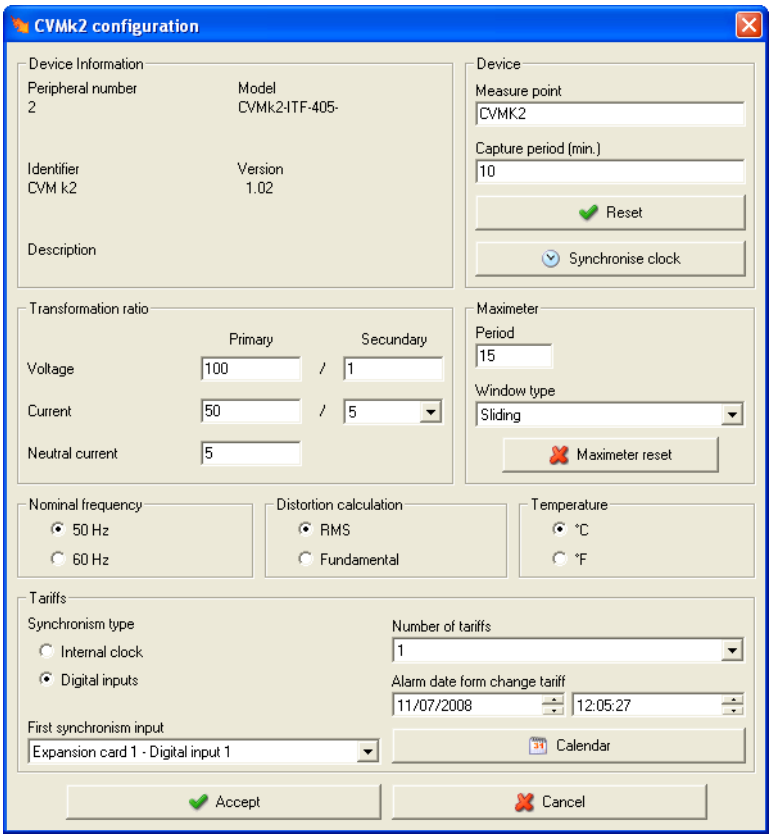
The option “Driver Parameter” has been detailed in section 3.1.1 Driver Parameters. When the device has an ‘*SD* Memory’ expansion card inserted, the data capture period will be configured in the option “Device parameters”.

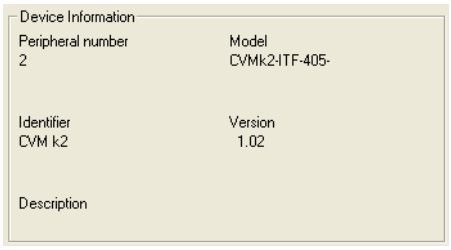
The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits.

The “Expansion Card” options will depend on the expansion card inserted in the device.

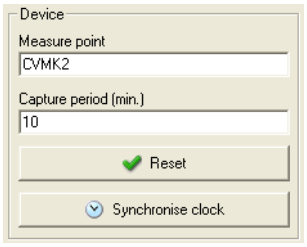
3.20.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

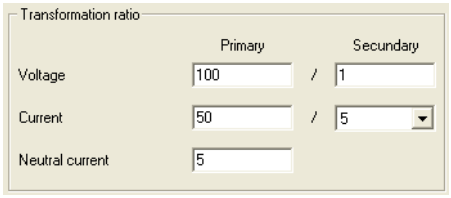




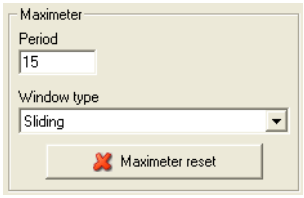
Shows general information.



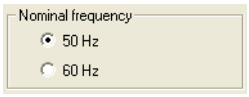
- **Measurement point:** Short description of the device for display and better identification on the device screen.
- **Capture period:** Data capture period, in minutes, for the generation of the log values when the equipment has an expansion card inserted in the memory.
- **Initialize energy counters:** Clicking on this button will reset the counters of the energy device
- **Synchronize clock:** Clicking this button will synchronise the date and the time of the device with the date and time of the PC.



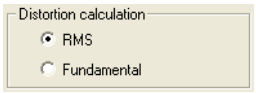
Programming of the voltage transformation ratios, current and neutral current of the device.



- **Period:** Is the integration period of the maximeter that can oscillate between 1 and 60 minutes.
- **Type of window:** Type of window used to save the maximeter value, it can be fixed or sliding.
- **Maximeter reset:** When the button is enabled, the device maximeter goes to zero.

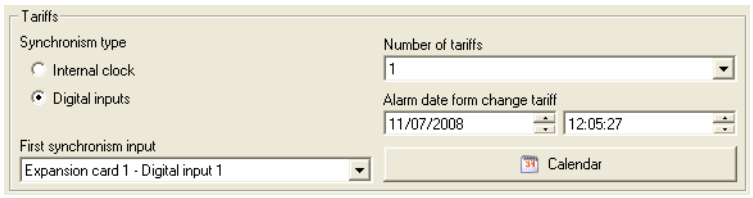


Configuration of the nominal working frequency of the device.



Using this selector the type of distortion the device will calculate can be configured.

Configuration of the units of the temperature value measured by the device.

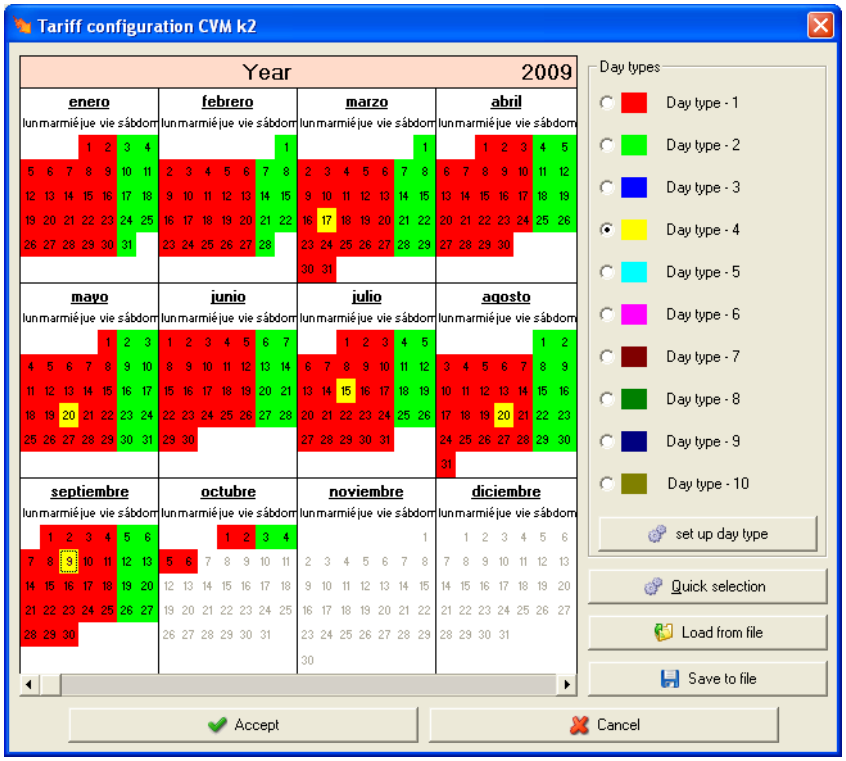


Tariff configuration of the device.

- **Type of synchronism:** Indicates to the device if the synchronism of tariffs is made by the device itself (internal clock), by the configured calendar, or the synchronism is given by an external signal (Digital Input). The digital input type will only be allowed when the device has digital input expansion cards.
- **First synchronism input:** Only if the kind of synchronism is by means of digital inputs. The digital inputs corresponding to tariff 1 must be chosen.
- **Number of tariffs:** The number of tariffs to be used in the device must be chosen.

- **Tariff change alarm date:** Only if the type of synchronism is by internal clock. A date for the device will be configured so that the device warns when a change must be made in the tariff calendar.

- **Calendar:** Only if the type of synchronism is by internal clock. Allows the tariff calendar by which the device will be governed to be configured.

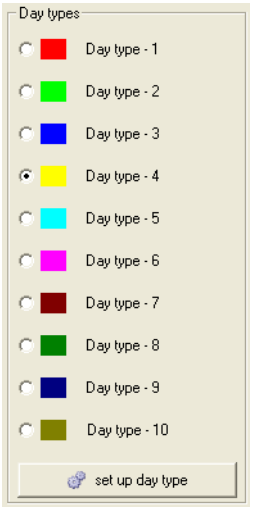


In this dialogue the tariff calendar configured on the device can be seen. Each day of the calendar will be marked with the colour of the type of day assigned.

Due to the fact that the device can be configured only 365 days in a year, the days will be shown as from the current day, for this reason the image begins on June 3, 2008 and ends on June 2, 2009. That is, if October 1st has been configured as type 1 (red), while no changes are made in the configuration of the calendar, October 1st of each year will be type 1.

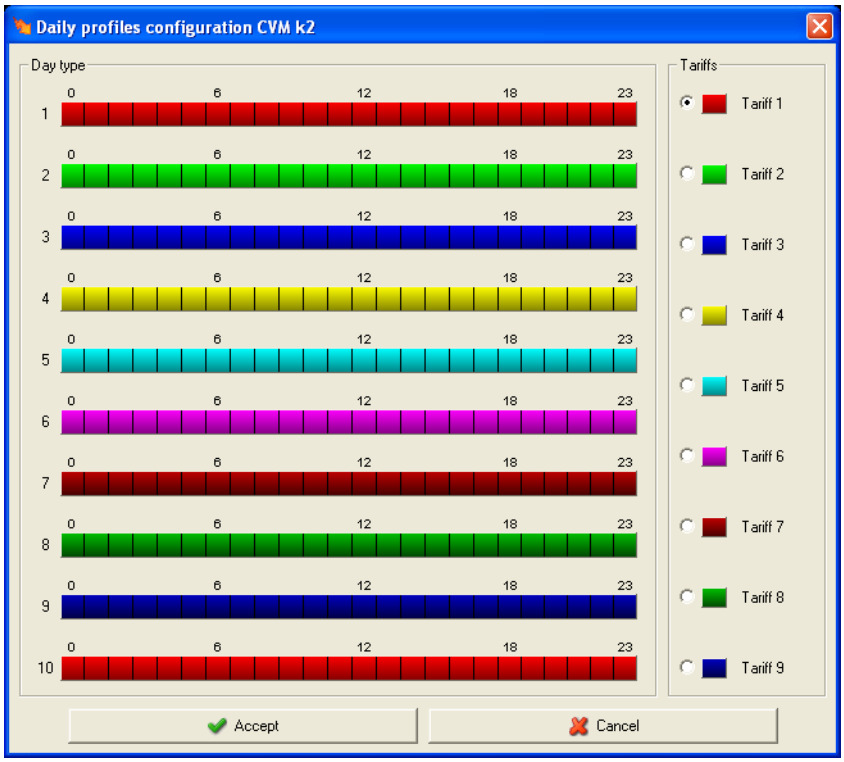
Selecting the days can be carried out in the following ways:

- Clicking the left mouse button on one day, marking only the day selected.
- Clicking the left mouse button on the start day, and then holding down the SHIFT key, click the left mouse button on the end day, hence choosing every day between the start day and the end day.
- Using the fast selection option.



Tariff types of day. Allows the type of day to be assigned to the different tariff calendar days to be selected. Clicking on the timetable with the left button of the mouse on a day will assign it the type of day selected.

Allows different types of day to be configured. Clicking on the button the following dialogue will appear.



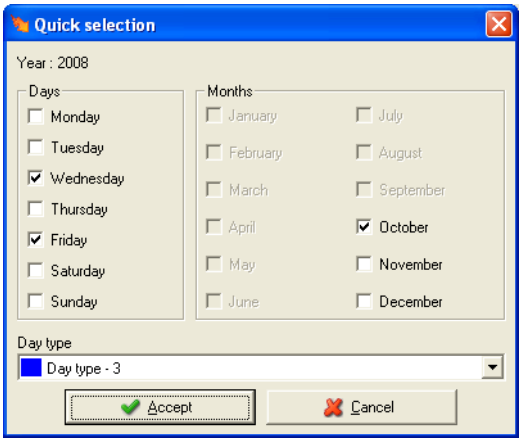
Where the different types of day divided into 1 hour sections are displayed on the left side of the dialogue, and on the right side the tariff to be implemented on that day can be selected.

To select the tariffs on the types of day, the tariff we want to assign must be selected and thereafter proceed in the following ways:

- Clicking the left mouse button on one of the type of day sections, marking only the section selected.
- Clicking the left mouse button on the initial section and then holding down the SHIFT key, Click the left mouse button on the final section, thus selecting all sections between initial and final. Bear in mind that

both the initial section and the final section must correspond to the same type of day.

with this option, selections will be made automatically. The following dialogue will appear.



In this case every Wednesday and Friday of October will be marked as day type 3.

Allows the calendar configuration and types of day to be loaded from a file previously saved on a disk. This option is useful when it is necessary to configure the same timetable on multiple devices.

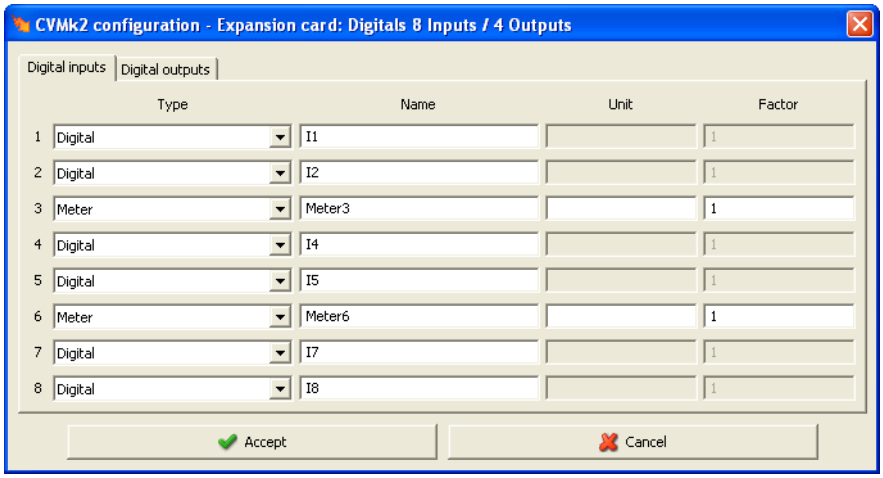
The calendar configuration and the types of day can be stored on a disk, and can be loaded on another device.

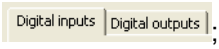
3.20.1.2 Expansion Cards

Depending on the number and type of expansion cards entered into the device the options to configure them may or may not appear.

3.20.1.2.1 Digital input / output

⚠ Depending on the card model, the number of inputs and outputs may vary.

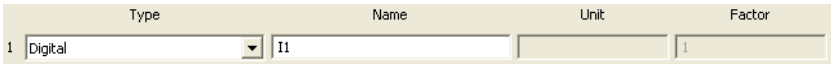


By way of 

; the configuration between the input configuration and the output configuration of the card may be changed. The previous image shows the configuration of the digital inputs.

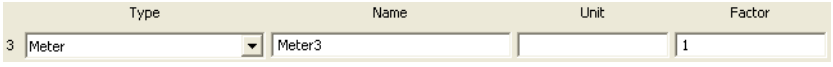
Each of the digital inputs may be configured as a digital input and therefore the status of the input can be monitored (open or closed) or used as a counter, counting the number of pulses that occur in the digital input.

Configuring the input as digital:



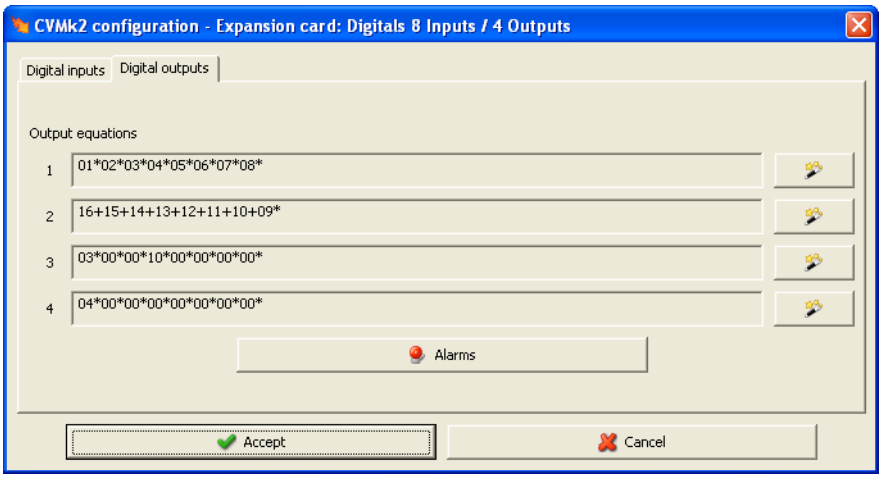
- **Type:** The type should be selected as digital.
- **Name:** Alphanumeric data type for the identification of the digital entry on the device display.

Otherwise it will be configured as a counter



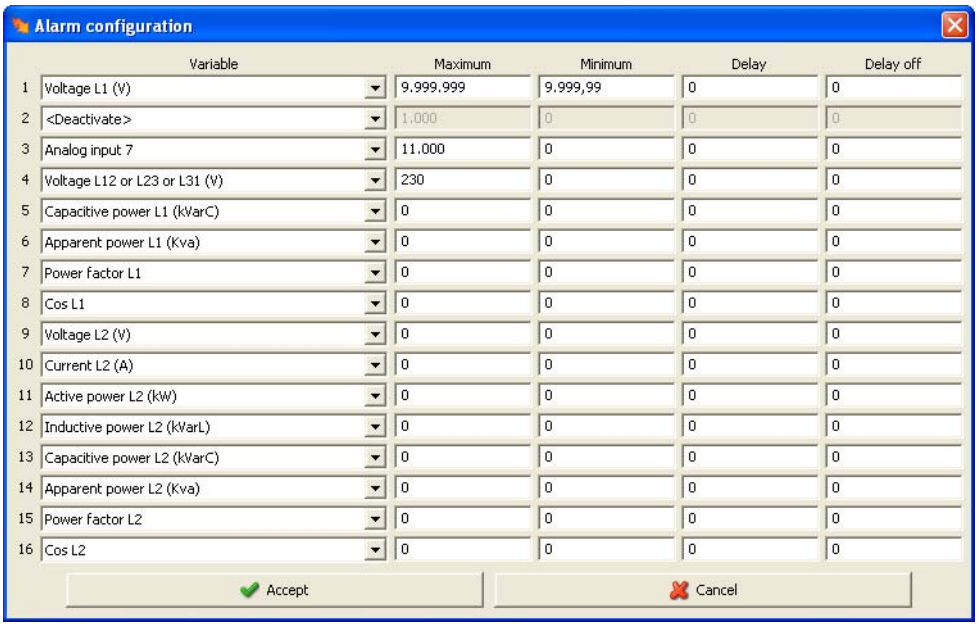
- **Type:** Must be selected as a counter type.
- **Name:** Alphanumeric type data to identity the counter on the device display.
- **Unit:** Alphanumeric type data to identify that this counter is a counter.
- **Factor:** Multiplicative value of each pulse detected at the input.

The configuration of the digital outputs is as follows:



Where for each of the outputs the output equation will be defined. This output equation corresponds to a conditional expression to decide when the device should act on the digital output depending on the alarms configured.

Configuration of alarms for use in the output equation. Clicking on the button the following dialogue will appear.

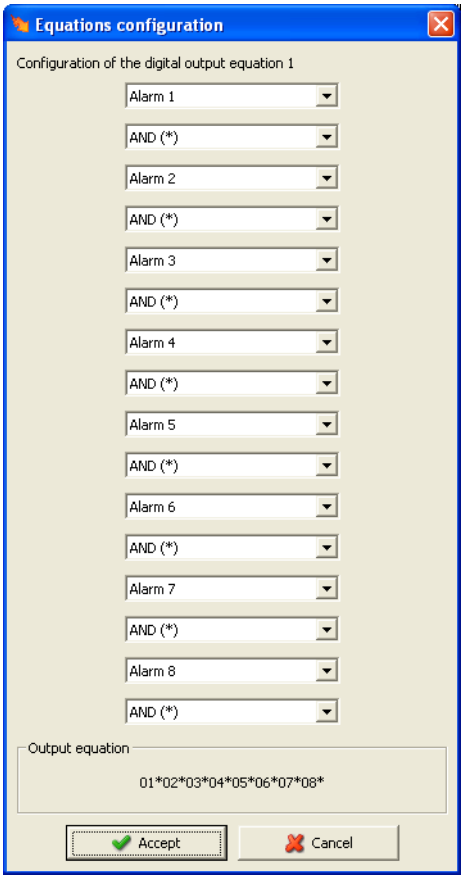


Where the 16 device alarms can be configured:

- **Variable:** In this field any of the parameters associated with the alarm can be selected, and any of the parameters measured by the device. The units in which the maximum and minimum values of the alarm are expressed are indicated in brackets.
- **Max:** The maximum value to control is configured. The range allowed depends on the selected variable.
- **Min:** The minimum value to control is configured. The range allowed depends on the selected variable.
- **Delay:** Delay in seconds in activating the alarm.

- **Delay off:** Delay in seconds in deactivating the alarm.

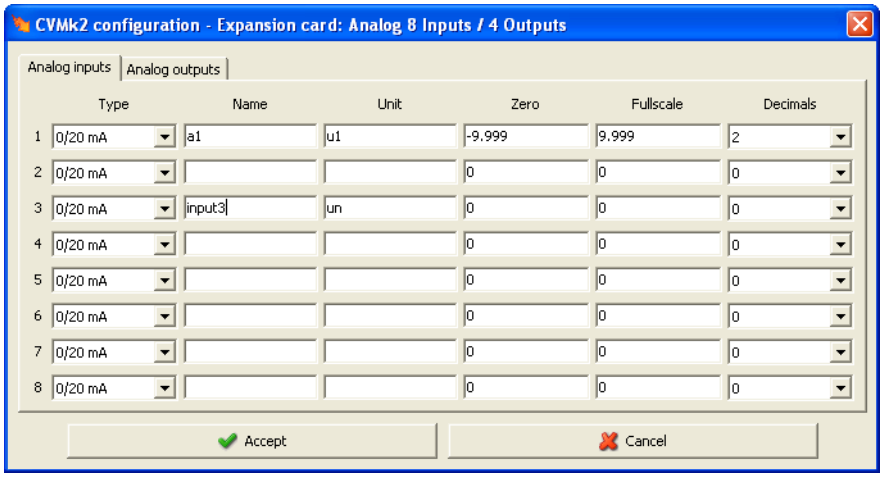
Allows output equations to be configured. Clicking on the button the following dialogue will appear.

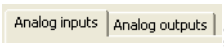


Where the alarm and the operation to be carried can be selected alternately (AND or OR). To obtain more information on the operation of the digital output equations consult the device manual.

3.20.1.2.2 Analogue inputs/ outputs

> ⚠ Depending on the card model, the number of inputs and outputs may vary.



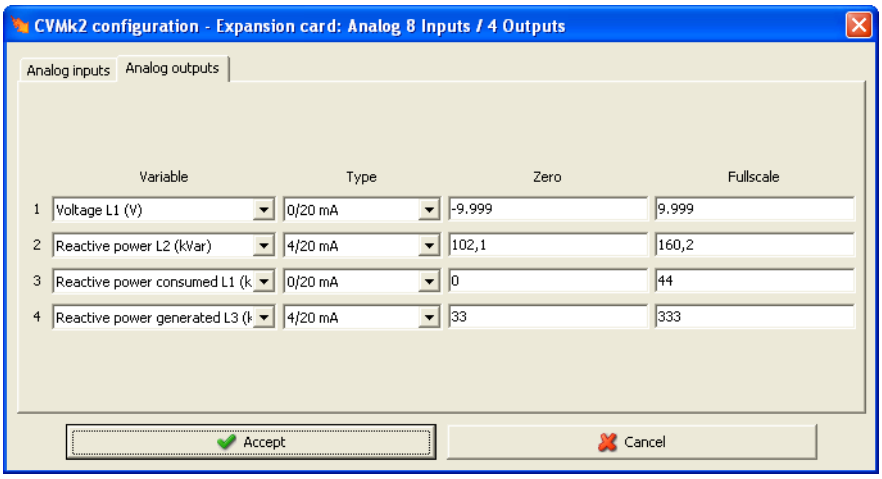
Using 

; the configuration between the input configuration and the output configuration of the card may be changed. The previous image shows the configuration of the analogue inputs.

For each of the analogue inputs the following can be configured:

- **Type:** Type of input, enables the different types of input signal accepted by the device to be selected.
- **Name:** A brief description of the analogue input for its identification on the screen of the device.
- **Unit:** A brief description of the measuring units of the analogue input so it can be viewed on the screen of the device.
- **Zero:** Parameter value that zero on the scale is assigned to.
- **Fullscale:** Value of the parameter to which the maximum value of the scale is assigned.
- **Decimals:** Number of decimals of the value measured by the analogue input.

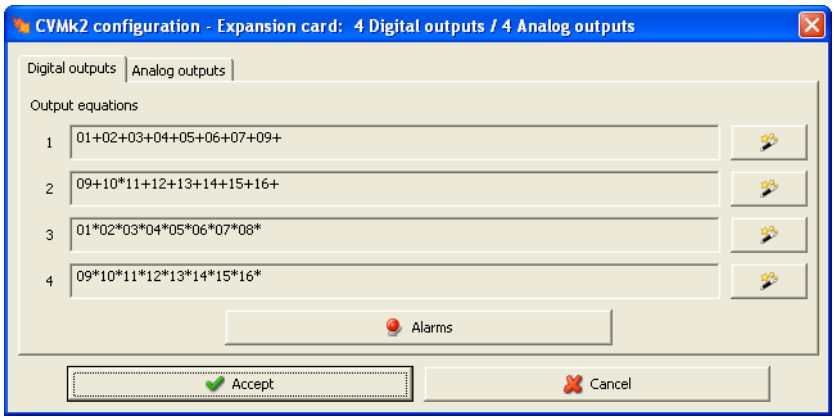
The configuration of the analogue outputs can be seen in the following picture:



Where for each of the analogue outputs the following can be configured:

- **Variable:** Permits any parameter that measures the devices that could be used for analogue outputs to be selected
- **Type:** Allows us to select from among the different types of output that the device can generate.
- **Zero:** Value of the parameter to which the zero of the scale is assigned.
- **Fullscale:** Value of the parameter to which the maximum value of the scale is assigned.

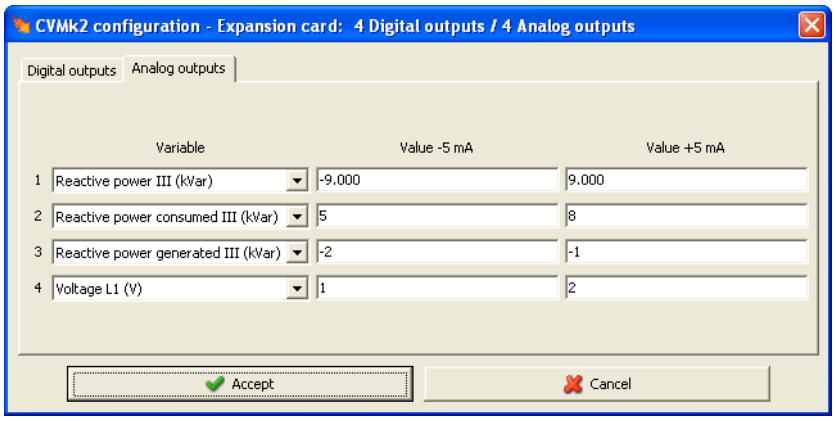
3.20.1.2.3 4 digital outputs / 4 analogue outputs



Using Digital outputs | Analog outputs; changes can be made between the digital outputs and the configuration of the analogue outputs of the card. In the previous image the configuration of the digital outputs can be seen

For more information on configuring the digital outputs consult the section 3.20.1.2.1 Digital Inputs /Outputs.

The configuration of the analogue outputs can be seen in the following picture:

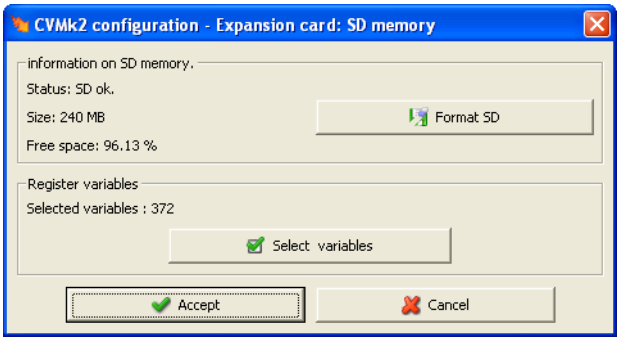


Where for each of the analogue outputs the following can be configured:

- **Variable:** Permits any parameter that measures the devices that could be used for analogue outputs to be selected.
- **Value -5 mA:** Value of the parameter which is assigned to the -5 mA output.
- **Value +5 mA:** Value of the parameter which is assigned to the 5 mA output.

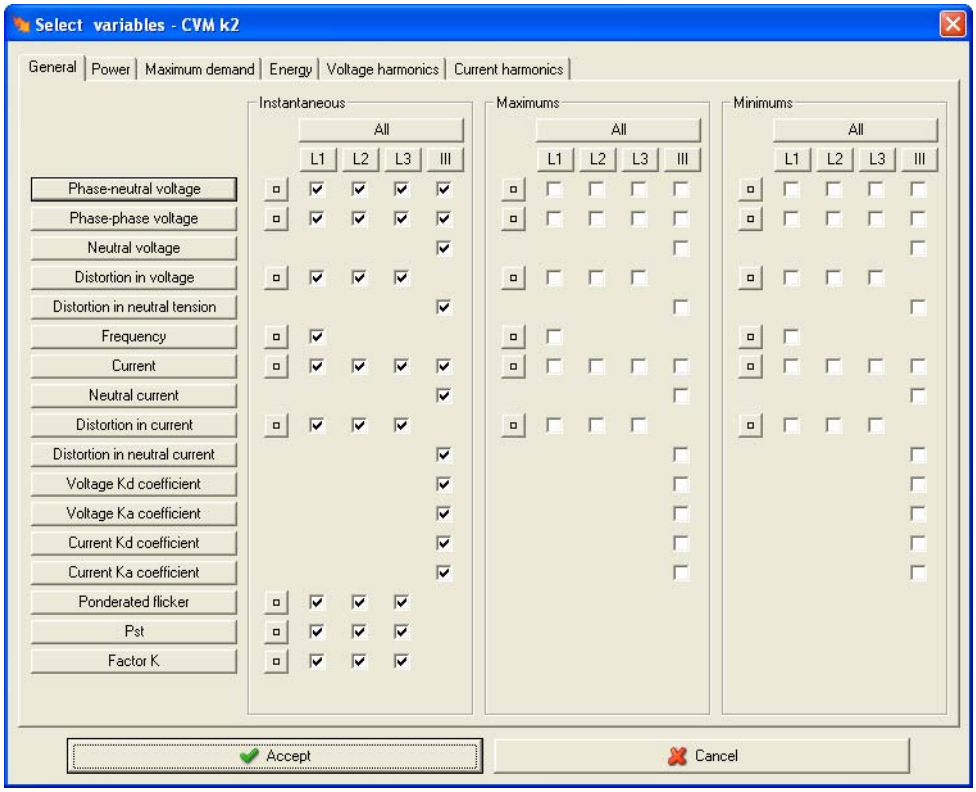
3.20.1.2.4 SD Memory

⚠ If the device has an SD Memory expansion memory, but the SD memory is not inserted, the data measured is not stored on the memory or by the software.



On the upper part of the dialogue information is shown about the SD Memory inserted into the device. It shows information such as the status, with which it is possible to know if the card works correctly or if there are any problems as for example if it is protected from overwriting, the size of the card and the remaining free space. It is also possible by Clicking the Format SD button; to format the SD card. It should be borne in mind that if the card is formatted it will lose all data not downloaded by means of the software.

The number of variables that the device saves in the log is shown on the lower part. Clicking the Select variables ;the variables that the device will save can be selected.



3.21 CVM-K HAR

3.21.1 Connection with Modbus TCP

The CVM-K HAR devices can connect on MODBUSTCP connections with some limitations. PowerStudio can read the values measured by the device but cannot read the configuration.

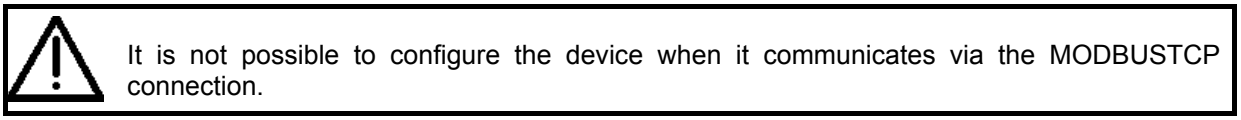
By adding a device on a MODBUSTCP connection, see section 3.10 TCP2RS Modbus TCP Converter, PowerStudio displays the following warning:

3.21.2 Driver options

The following is the options menu:

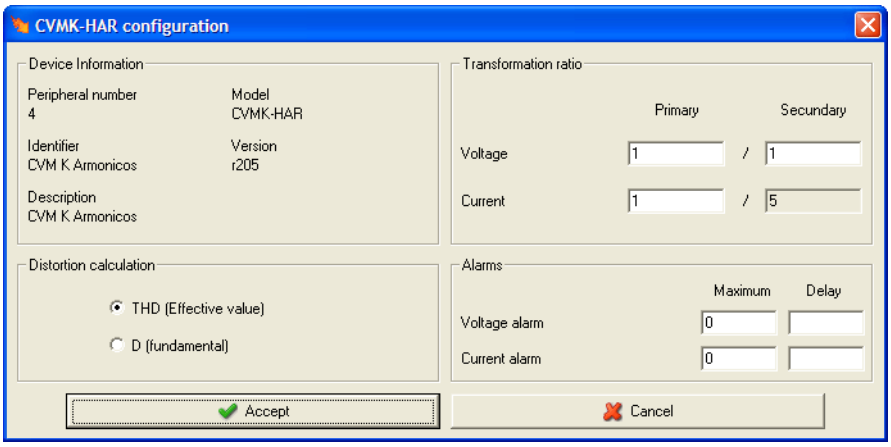
The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits.

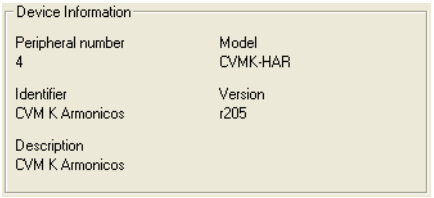
3.21.2.1 Device parameters



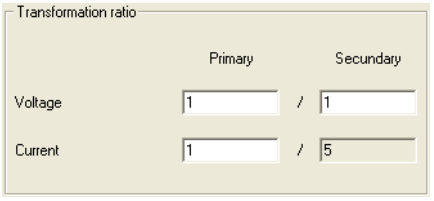
It is not possible to configure the device when it communicates via the MODBUSTCP connection.

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.



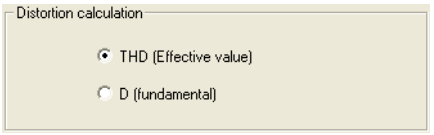


Shows general information.

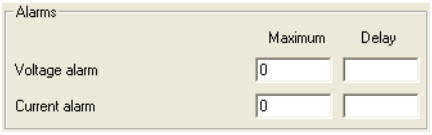


- **Voltage transformation ratio:** Primary and secondary voltage programming. The value of the voltage primary should be between 1 and 999999 V and the secondary between 1 and 999 V. The product between the primary value and the primary current must be the same or less than 20.000.000.

- **Primary of the current transformer:** This is the primary current value of the device. It can be between 1 and 10000 A. The secondary current is 5A on the CVM-K HAR.



Using this selector, the type of distortion that the device will calculate can be configured.



Should an additional module with two relay outputs be available, it can be configured as an alarm mode with the THD or D variables on voltage and on current.

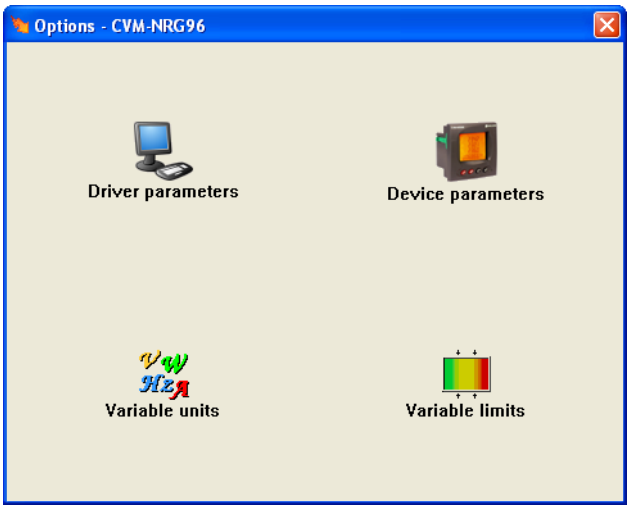
Maximum value. When the value read by the CVM-K HAR device exceeds the programmed value, the device will close the contact corresponding to the programmed alarm. This maximum programmed value will be a % of THD or D.

Delay, both on the connection and disconnection of the alarm relay. This value will be expressed in seconds

3.22 MINI CVM and CVM NRG-96

3.22.1 Driver options

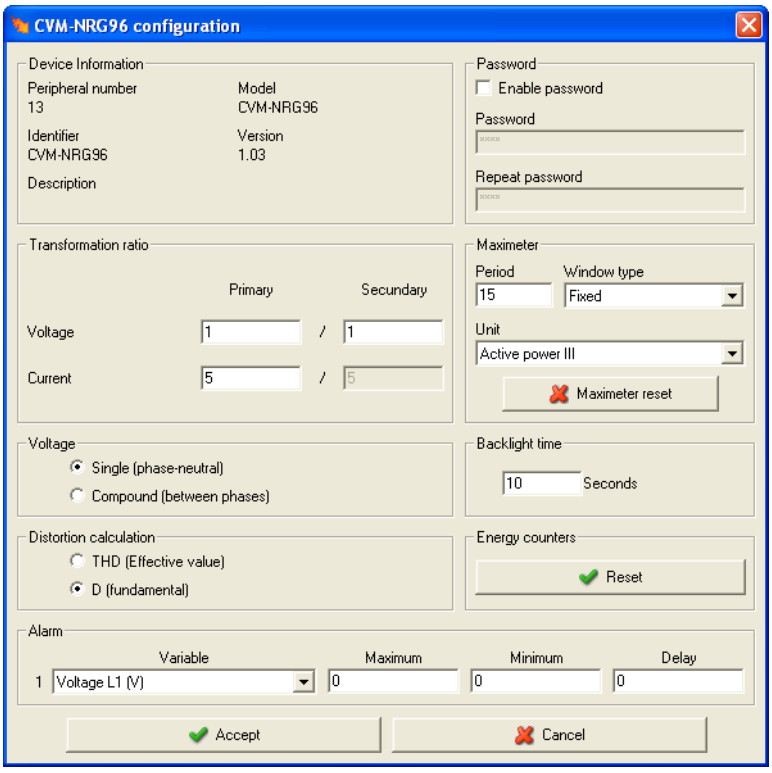
The following is the options menu:

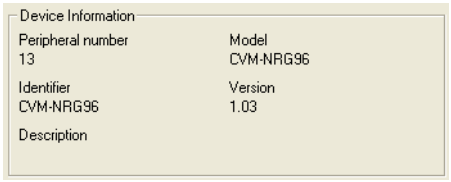


The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits.

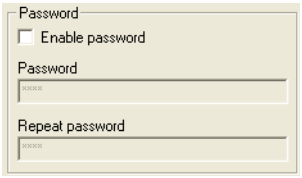
3.22.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

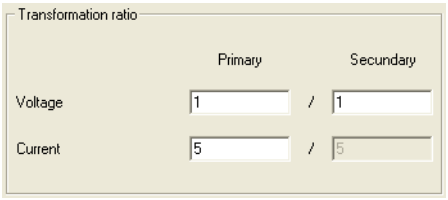




Shows general information.



Allows us to enable or disable the password to block the configuration using the device keyboard.

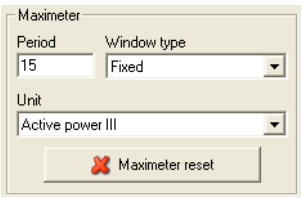


Depending on the version connected, programming of the voltage transformation ratio can be disabled.

- **Voltage transformation ratio:** Primary and secondary voltage programming. The product between the primary value and primary current has to be equal or less than 20,000,000. The value of the primary, depending on the fullscale of the equipment, must be between 1 and the corresponding value from the following table:

Full-scale :	Maximum value.
110V	99,999
250V	70,000
275V	70,000
300V	70,000
500V	40,000

- **Current transformation ratio:** This is the primary current value the device has. The value can be between 1 and 10,000 A. The secondary current is 5A on the CVM-96.

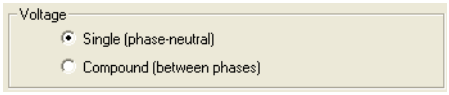


- **Period:** Is the integration period of the maximeter that can oscillate between 1 and 60 minutes.

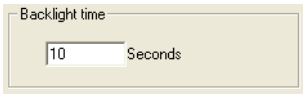
- **Type of window:** Type of window used to save the maximeter value, it can be fixed or sliding.

- **Unit:** The maximum demand can be calculated with active power III, apparent power III, current III or phase current depending on the device.

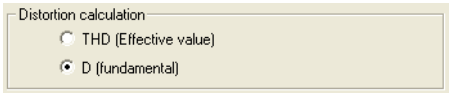
- **Maximeter reset:** When the button is enabled, the device maximeter goes to zero.



Selecting the type of voltage calculated.

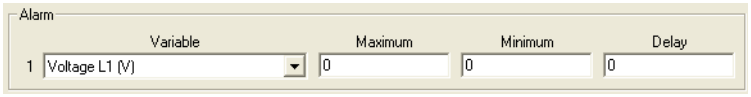


Configuration of the "*backlight*" disconnection. The value should be between 0 and 99 seconds.



Using this selector, the type of distortion that the device will calculate can be configured.

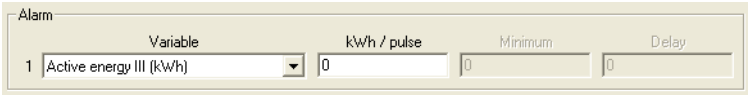
On clicking the button the energy counters on the device will return to zero.



This section shows the configuration of the device relay output and the option to configure it with the values desired is given. For CVM-MINI devices the two relay outputs of these devices can be configured.

- **Variable:** The parameters associated with the relay are indicated in this field. The output is programmed as an alarm or energy pulse with any of the parameters measured by the device being able to be controlled. The units in which the maximum and minimum values of the alarm are expressed are indicated in brackets.

- **Max:** In this box the maximum value to control is indicated. If an energy variable is selected, the value of each pulse will be indicated. This will be displayed as follows:



- **Min:** In this box the minimum value to control is indicated. If you select an energy variable, this field will remain disabled.

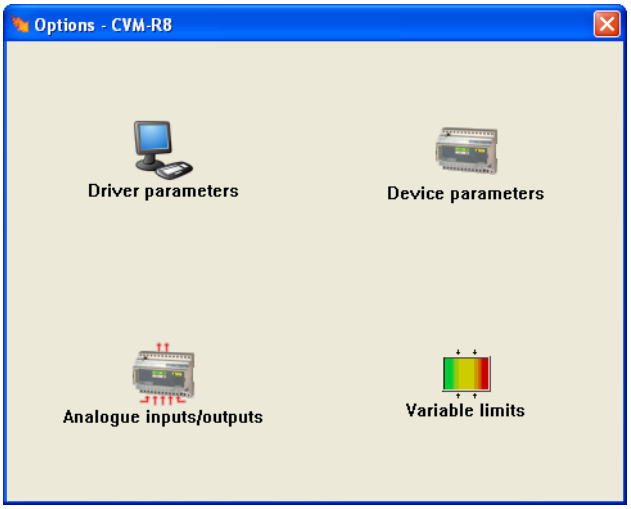
- **Delay:** Alarm delay in seconds. The maximum value is 9999 seconds. This field will remain deactivated if an energy variable is chosen

3.23 CVM-R8

Communication will not be possible with the CVM-R8 through a MODBUSTCP connection.

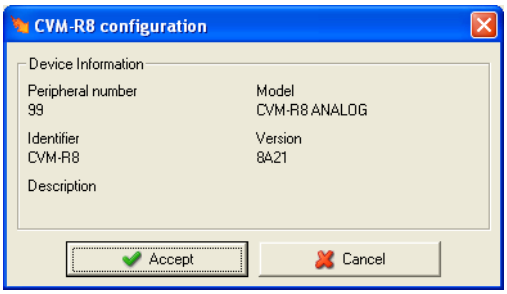
3.23.1 Driver options

The following is the options menu:



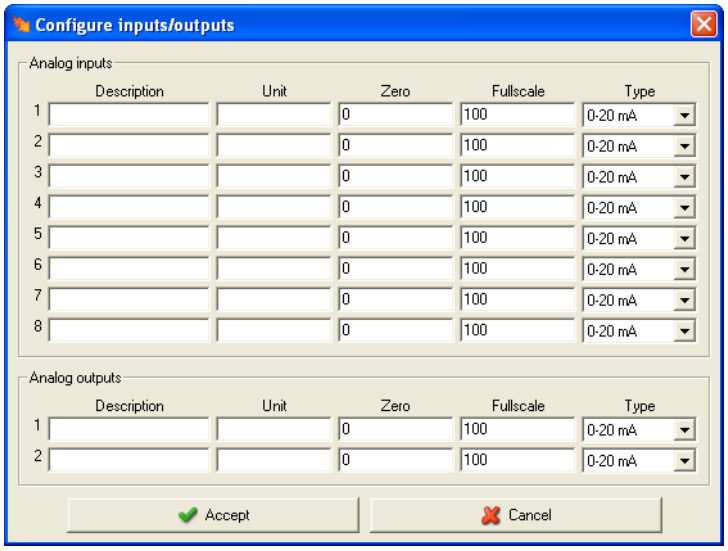
3.23.1.1 Device parameters

In the case of CVM-R8 it will not be possible to configure any parameters of the device; it will only be possible to show information about it.



3.23.1.2 Analogue inputs and outputs

From this dialogue the analogue inputs on the CVM-R8 devices with analogue inputs and/or outputs can be configured.



- **Description:** Alphanumeric type information which enables a brief description to be entered for better identification.
- **Unit:** Alphanumeric type data which permits a brief description of the units to be entered.
- **Zero:** Value of the parameter to which the zero of the scale is assigned.
- **Fullscale:** Value of the parameter to which the maximum value of the scale is assigned.
- **Type:** Type of entry, allows between 0-20 mA, 4-20 mA or 0 -? to be chosen V

3.23.1.3 Variable limits

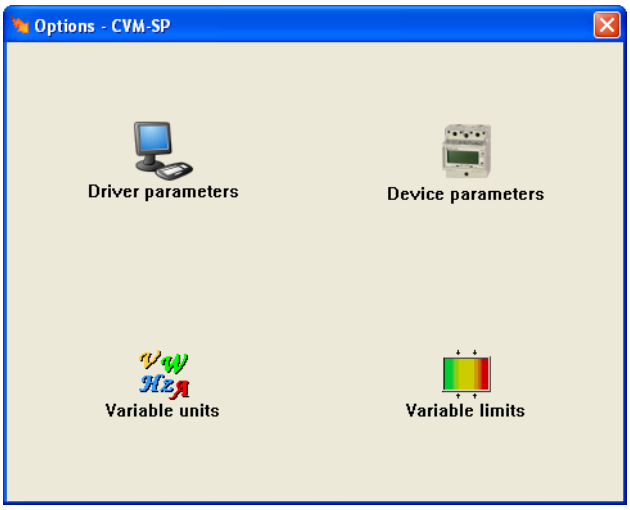
Only for CVM-R8 devices with analogue inputs.

This option has been detailed in section 3.1.3 Variable limits.

3.24 CVM-SP

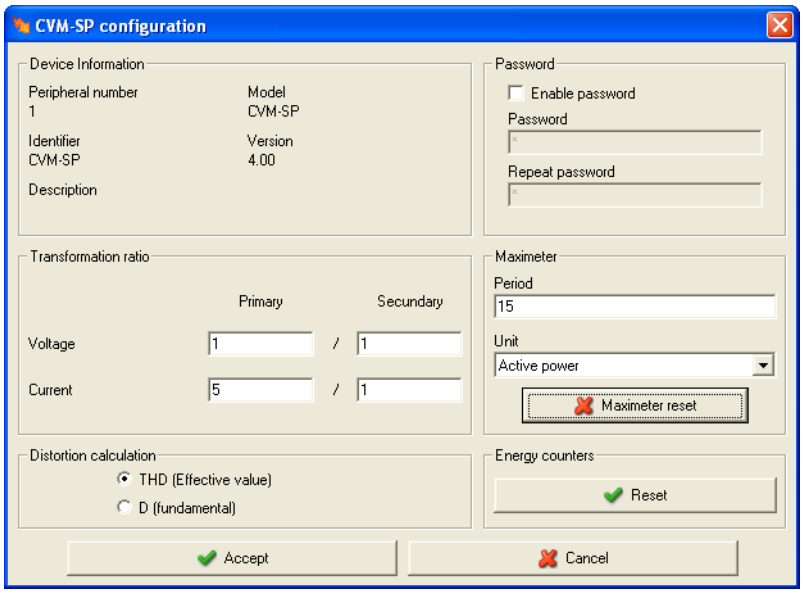
3.24.1 Driver options

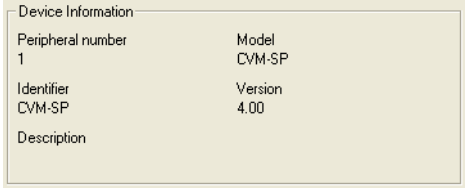
The following is the options menu:



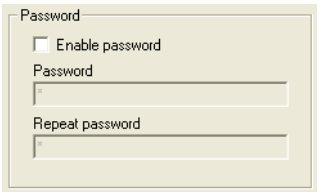
3.24.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

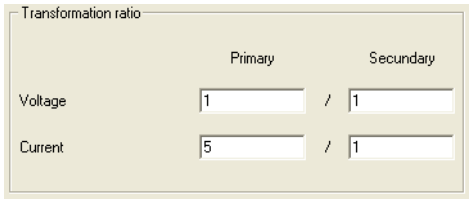




Shows general information.



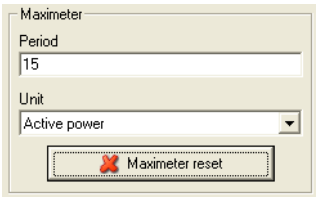
Enables the password to be enabled or deactivated to block the configuration of the device by means of the keyboard.



- **Voltage transformation ratio:** Primary and secondary voltage programming. The product value between primary value and primary current has to be equal or less than 20,000,000. The primary value, depending on full scale, must be between 1 and the value of the following table:

Full-scale :	Maximum value.
110v	99.999
275v	70.000
300v	70.000
500V	40.000

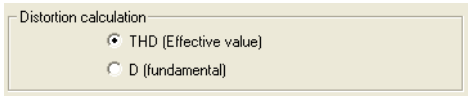
- **Current transformation ratio:** This is the primary current value the device possesses. The value can be between 1 and 10,000 A. The secondary current is 5A on the CVM-144.



- **Period:** Is the integration period of the maximeter that can oscillate between 1 and 60 minutes.

- **Unit:** The maximum demand can be calculated with active power III, apparent power III, current III or phase current depending on the device.

- **Maximeter reset:** When the button is enabled, the device maximeter goes to zero.



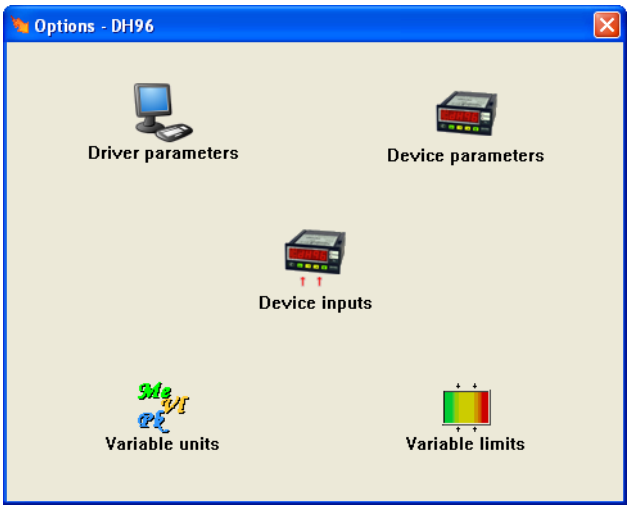
Using this selector the type of distortion that the device will calculate can be configured.

On clicking the button the energy counters on the device will return to zero.

3.25 DH-96

3.25.1 Driver options

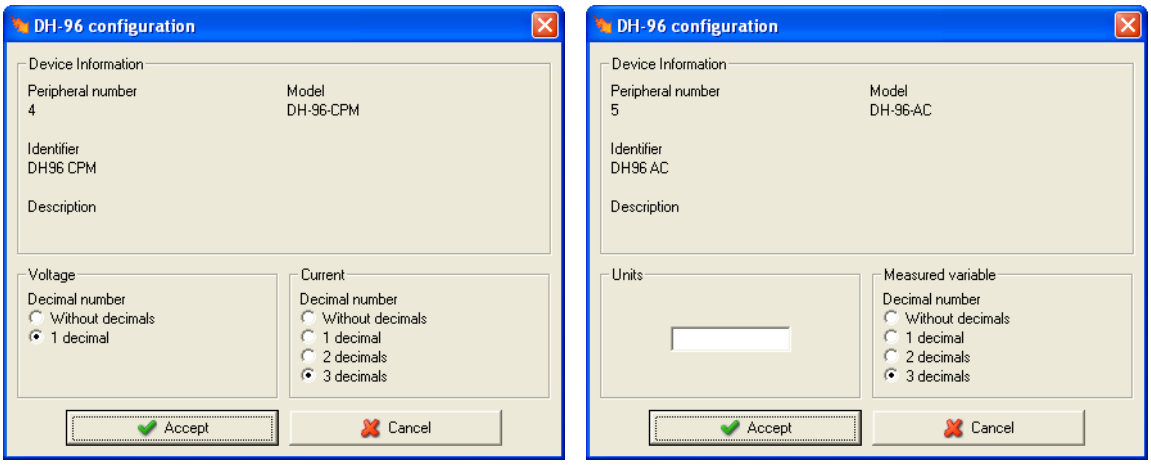
The following is the options menu:

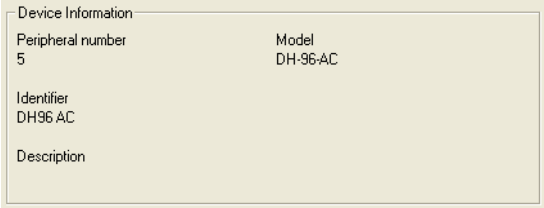


The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits. The option ‘Device inputs’ only appears on DH-96 CT devices.

3.25.1.1 Device parameters

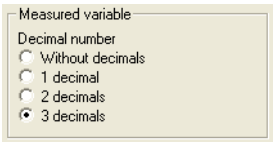
On DH-96 devices it will not be possible to modify internal parameters, and it will be necessary to change them manually on the device keyboard. For more information on how to modify the parameters see the manual that comes with the device.



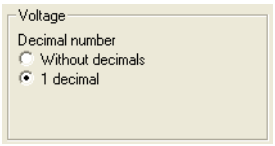


Shows general information.

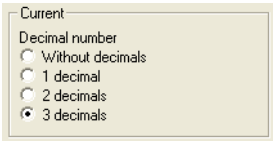
Alphanumeric type data which permits a brief description of the DH-96 units of measurement to be entered. These units will be displayed in the data display, in no case will they be sent to the device. This parameter will not appear on DH-96 CT units, on the DH-96 CT equipment a brief description of the units can be entered on the input screen, 3.25.1.2 Inputs.



Only for DH-96 AC, DH-96 CT, DH DC-96, DH-96 WG units. The number of decimal places used when displaying the variable measured on the equipment can be configured. This parameter will be used solely as information on your computer, and at no time will it be sent or read by the equipment.



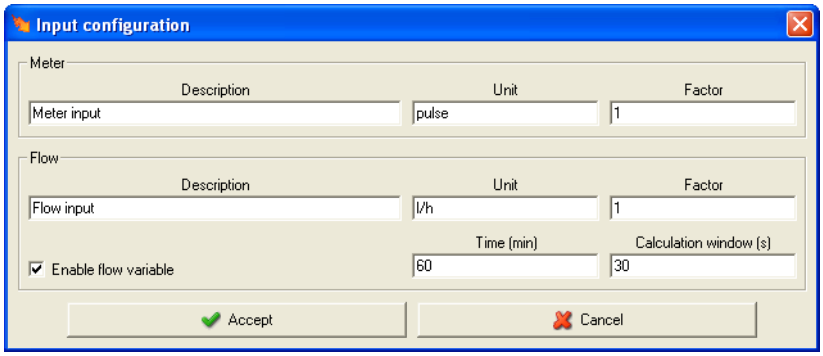
Only for DH-96 CPM units. The number of decimals with which the voltage on the equipment is displayed can be configured. This parameter will be used solely as information on your computer, and at no time will it be sent or read by the equipment.



Only for DH-96 CPM units. The number of decimals with which the current on the equipment is displayed can be configured. This parameter will be used solely as information on your computer, and at no time will it be sent or read by the equipment.

3.25.1.2 Inputs

Only for DH-96 CT devices



This screen lets the flow and counter variable that can be used on the DH-96 CT equipment be configured.

- **Counter Variable**
  - **Description:** Alphanumeric type data which allows a brief description of the input for better identification.
  - **Unit:** Alphanumeric type data which enables a brief description of the input units to be entered.
  - **Factor:** Multiplier factor to be applied to the value read from the device.

- **Flow variable:** The input will be treated as a flow counter. The value of this variable is calculated from the counter variable value read from the device.
  - **Enabling flow variable:** Using this option it is possible to enable or disable the use of the software of the device input as if it were a flow counter. If this is disabled it will not be displayed nor will it be possible to use this variable on the software.
  - **Description:** Alphanumeric type data which allows a brief description of the input for better identification.
  - **Unit:** Alphanumeric type data which permits a brief description of the units to be entered.
  - **Factor:** multiplier to be applied to the value read from the device.
  - **Time:** Parameter to calculate the flow value.
  - **Calculation window:** Window time, in seconds, that the software will use to calculate an estimate of the flow, taking into account the value of the device counter.

3.26 EDMk

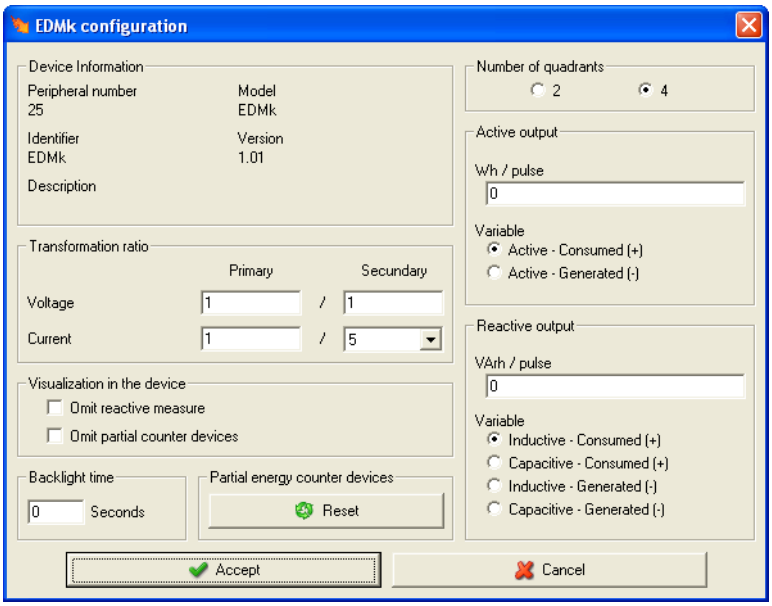
3.26.1 Driver options

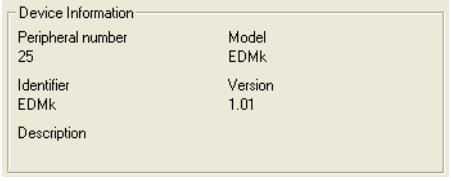
The following is the options menu:

The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits

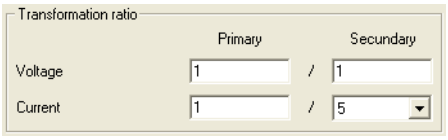
3.26.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.





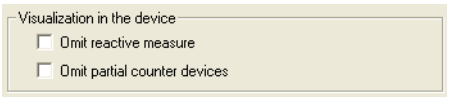
Shows general information.



Configuration of the transformation ratio of the device.

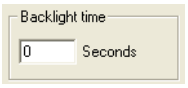
- **Voltage transformation ratio:** Primary and secondary voltage programming. The product between the primary value and the primary current must be the same as or less than 20.000.000. The primary value must be between 1 and 999.999 V while the secondary can be between 1 and 999 V.

- **Current transformation ratio:** This is the primary and secondary current value the device has. The primary can value between 1 and 9999 A and the secondary between 1 or 5 A.

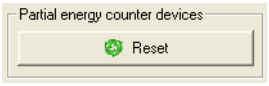


Visualisation on the screen of the device

- **Omit reactive measurement:** The reactive measurements are not shown on the device screen, although they will continue to be visualised on the software display screens.
- **Omit partial counters:** Partial counter measurements are not shown on the screen of the device nor on the display screens of the software.

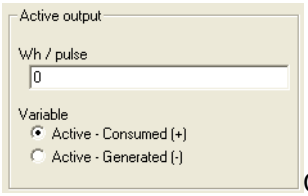


Configuration of the "*backlight*" disconnection. The value should oscillate between 0 and 10 seconds.

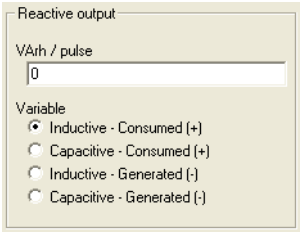


On clicking the button all the partial counters of the device will be started.

Configuration of the number of quadrants. With only 2 quadrants the consumed energy counters will be taken into consideration and with 4 the consumed and generated energy counters.



Configuration of the output relay of the active energy. The number of Wh equivalent to an output impulse and the variable that will be measured to give this pulse. If the pulse value is 0, the output will be treated like a standard digital output, enabling it value to be forced from 0 to 1.



Configuration of the output relay of the active energy. The number of VArh equivalent to an output pulse and the variable that will be a measured to give the pulse can be configured. If the pulse value is 0, the output will be treated like a standard digital output enabling it value to be forced from 0 to 1.

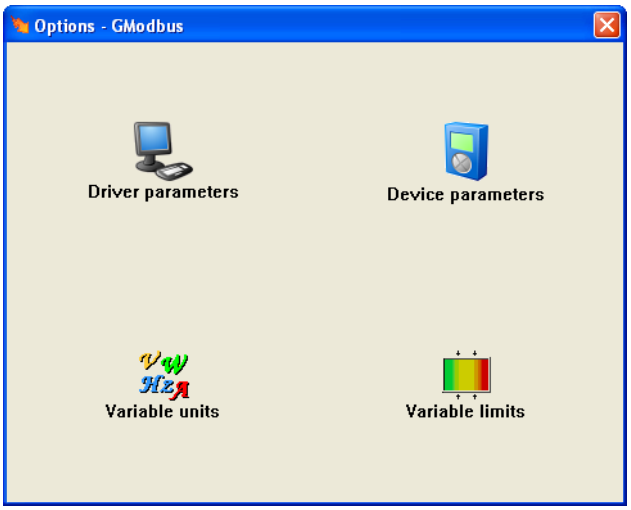
3.27 Generic Modbus

Due of the variety of devices that communicate with Modbus protocol currently on the market, a generic device to enable quick and easy communication with these devices has been created.

Once the variables to be read have been configured, the device will behave in a manner similar to other devices with which the program communicates.

3.27.1 Driver options

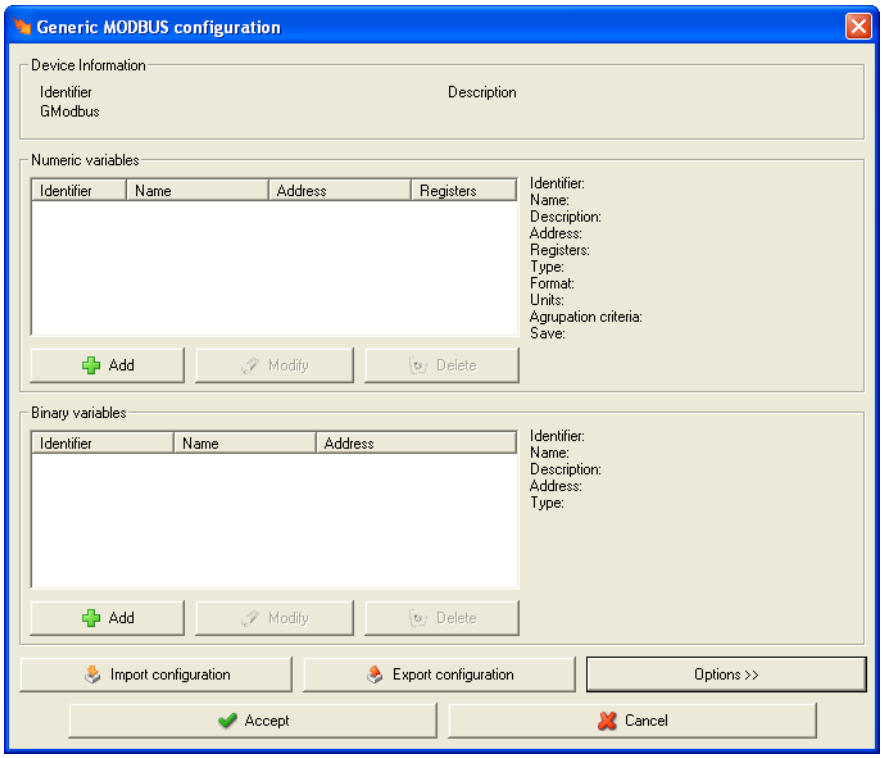
The following is the options menu:

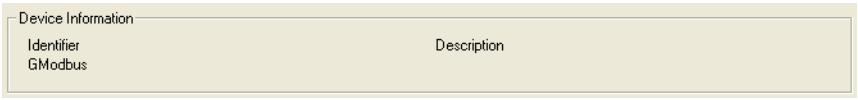


The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits.

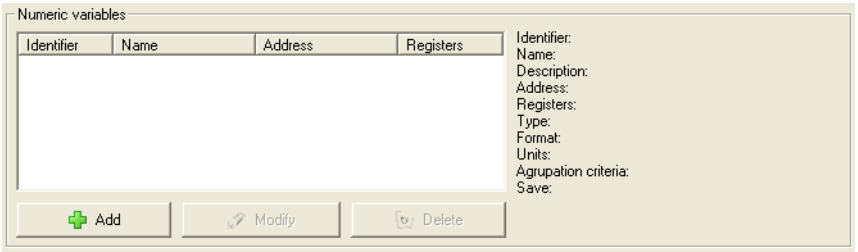
3.27.1.1 Device parameters

This screen is used to configure the variables that should be requested from the device. The variables are in two groups, numeric variables (voltages, currents, counters, etc.) and binary variables (typically digital inputs and outputs).

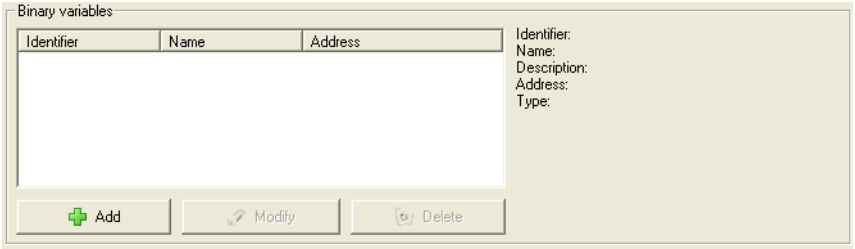




General information on the device.



Configuration of the numeric variables of the device. See section 3.27.1.1.1 Numeric variables

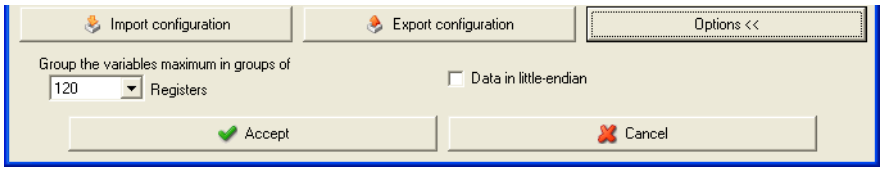


Configuration of the binary variables of the device. See section 3.27.1.1.2 Digital variables.

Allows the configuration of numeric and binary variables of a file previously saved on the disk to be loaded. This option is useful when the same variables have to be configured on several devices

Allows the configuration of numerical and binary variables to be saved on a disk and then loaded onto another Generic Modbus TCP device.

Allows advanced configuration options on the device to be shown or hidden.

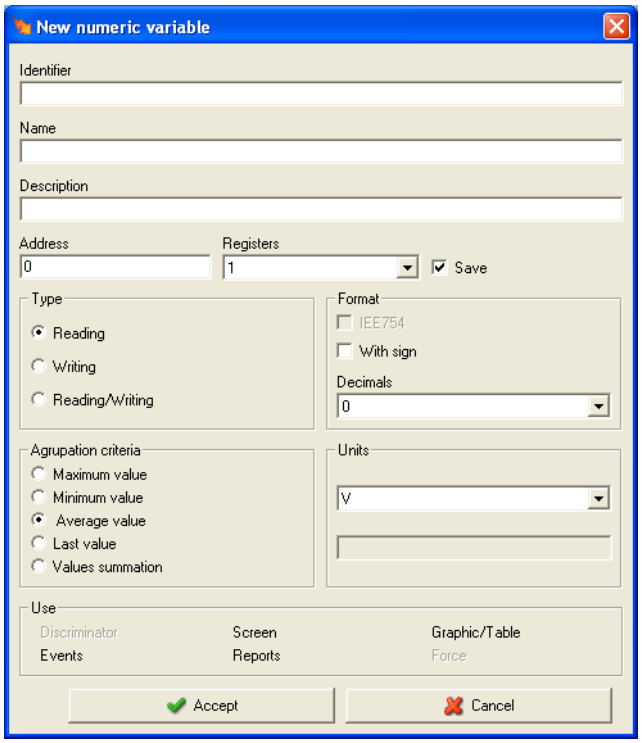


- **Brings together variables in groups:** These parameters permit the maximum size of the frames to be configured in communications for those devices which do not permit communication with frames of a maximum size greater than that of the Standard modbus. To carry out the minimum number of possible requests and thus penalise as little as possible the communication, the programme will try to group together the variables configured in groups of variables. This parameter can indicate the maximum grouping permitted

- **Data in little-endian:** By default the data sent by devices is considered to come in big-endian. If the device returns it in little-endian this option should be enabled.

3.27.1.1.1 Numeric variables

Click the “Add" or “Modify” button and the dialogue will appear to configure the numeric variable.



Where

- **Identifier:** Enables the identification of each one of the numeric variables to be used in expressions and conditions, see section 14.2 Expressions and conditions.

- **Name:** Name of the numeric variable used to identify it better.

- **Description:** Short description of the variable.

- **Address:** Modbus map address of the device where the variable can be found.

- **Records:** Number of registers which occupy the variable on the Modbus map.

- **Save:** Indicates if the device value read should be saved on the value log or not.

- **Type:** Selects the type of variable; reading, writing or both. If the variable is write or read/write the value can be forced on the device.

- **Format:** Indicates the format that the device returns the variable value. The value can be expressed in the IEE754 format, with a sign and the number of decimal points can be indicated.

- **Grouping criteria:** Enables the grouping criteria of the values of the variable to be selected in graphs, tables, reports and the value to be saved in the values register. For example, if in the period between saving information we have 3 values (10, 12 and 7) these will be saved in the log register.
    - Maximum value. The maximum value of the 3 (12) will be saved
    - Minimum value: The minimum value of the 3 (7) will be saved.
    - Average value: The average value of the 3((10 + 12 + 7) / 3 = 9.66) will be saved.
    - Last value: The last value will be saved(7).
    - Sum of the values: The last value will be saved(7).

  In the case of clusters of values in graphs, tables and reports the same criteria will be followed except when it is the summation of values where the sum of 3 values is shown (10 + 12 + 7 = 29).

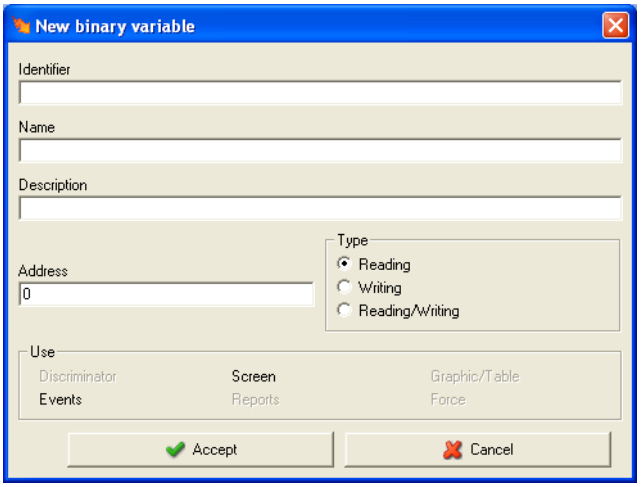
- **Units:** Units in which the value is expressed. You can select one of the predefined units or define a new user unit.

- **Use:** Shows where the variable may be used in the rest of the program.

For more information on the digital map of numeric variables and its configuration consult the device manual.

3.27.1.1.2 Digital variables

Push the button “Add" or “Modify” the dialogue will appear to configure the binary variable.



Where

- **Identifier:** Allows each of the binary variables to be used in expressions and conditions, can be identified, see section 14.2 Expressions and Conditions.
- **Name:** Name of the numeric variable used to identify the variable better.
- **Description:** Short description of the variable.
- **Address:** Modbus map address of the device where the variable can be found.
- **Type:** Selects the type of variable; i.e., read, write or both. If the variable is write or read/write the value can be forced on the device
- **Use:** Shows where the variable may be used in the rest of the program.

For more information on the map of binary variables and its configuration consult the device manual.

3.28 LM-24 M

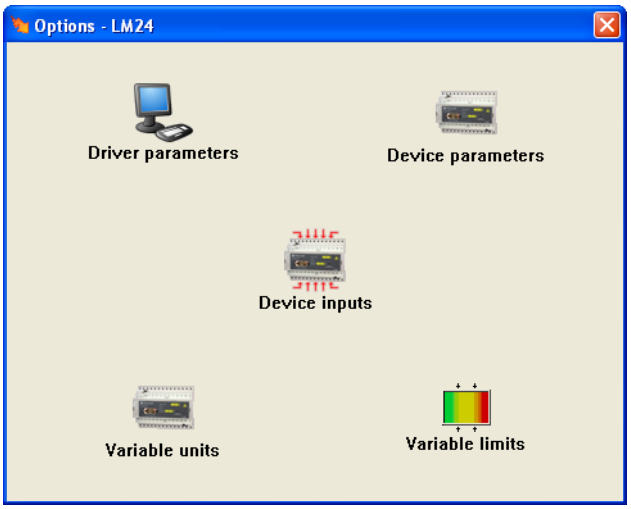
This software only communicates with LM-24 M devices.

3.28.1 Driver options

The options of the LM-24 M can be accessed from

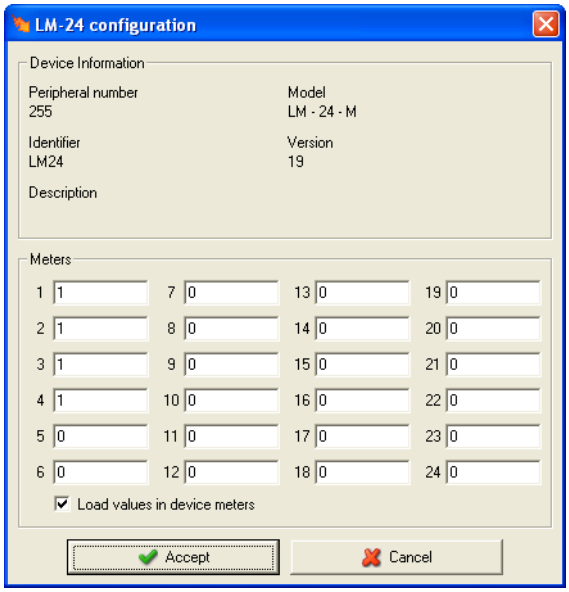
- *See Menu:* See section 2.4.3 Display options.
- *Toolbar:* See section 2.4.4 Toolbar

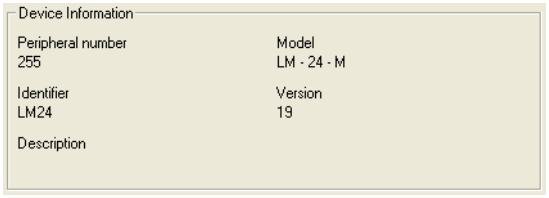
The following is the options menu:



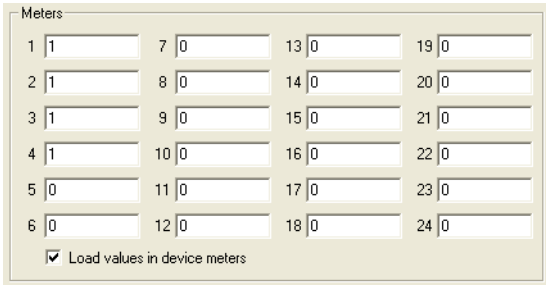
3.28.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.





Shows general information.

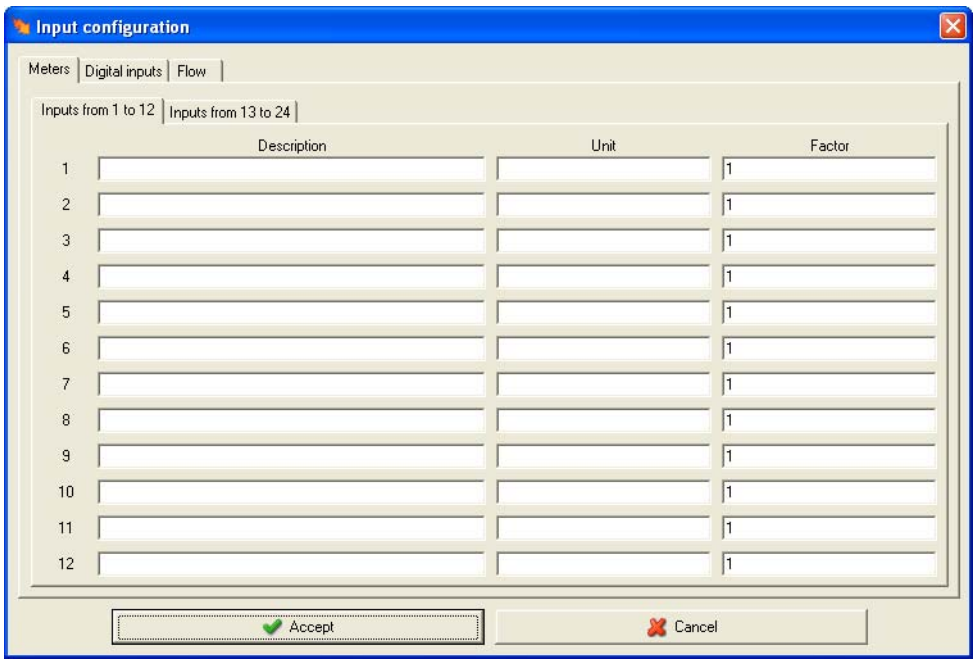


This part of the configuration corresponds to the device counters. If the selector , is checked, on sending the configuration the energy counter will be loaded with the values entered into the corresponding boxes.

3.28.1.2 Device inputs

For each of the inputs of the LM-24 M, three variables will be available, a digital display to show the status of the input (open / closed), a counter variable to show the number of pulses detected at the input and finally a flow variable calculated by the software as an estimate of the pulse frequency on the input during a space of time.

By means of this dialogue the LM-24 M inputs can be configured.



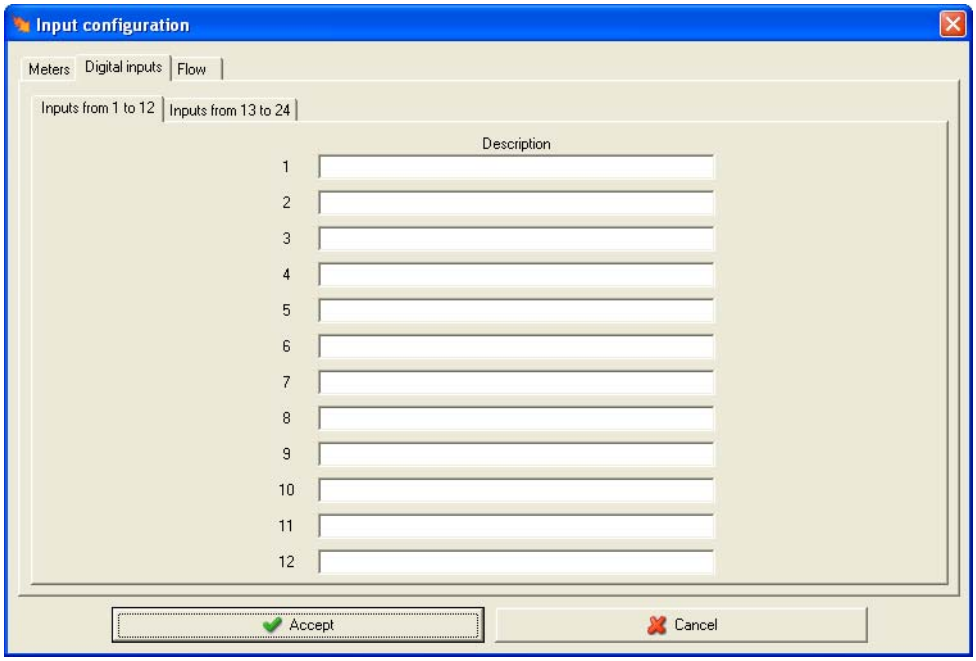
By mean of the

the display configuration of different types of variables can be configured. The previous image shows the configuration of the counters,

Where:

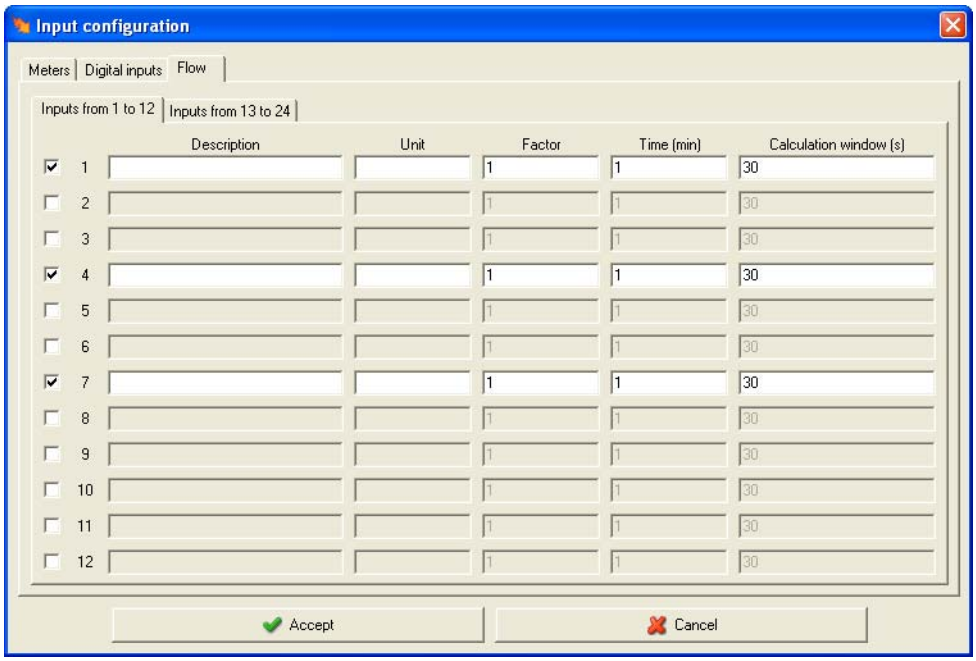
- **Description:** Alphanumeric type which permits a brief description of the counter so it can be identified better.
- **Unit:** Alphanumeric type data which permits a brief description of the units where the counter to be entered is displayed.
- **Factor:** Multiplicative value of each input pulse.

For digital inputs:



- **Description:** Alphanumeric type data which permits a brief description of the digital input to be entered for better identification.

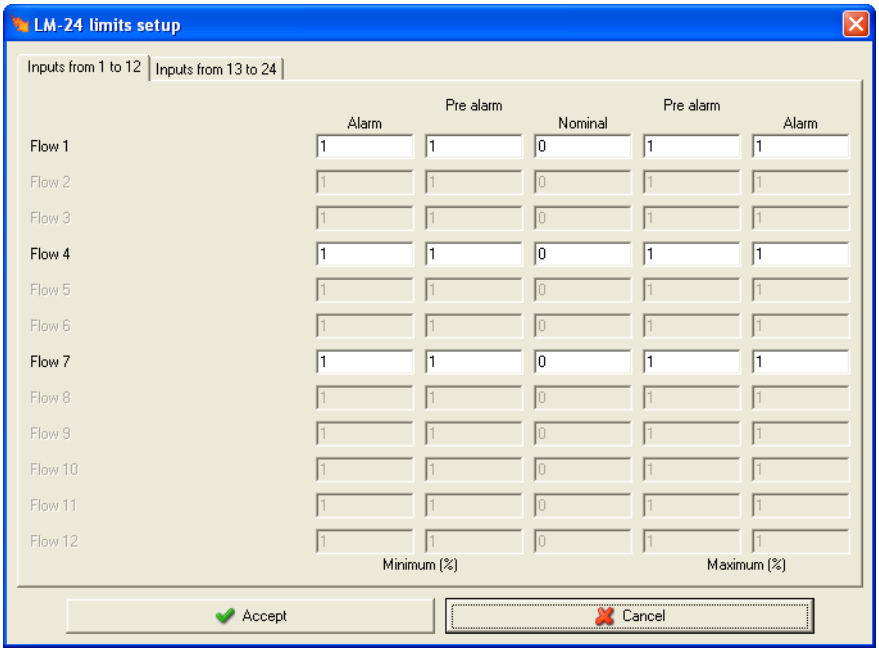
Finally for the flow configuration:



Checking the selector ☑; will activate the flow variable. Remember if the selector is not checked it will not be possible to view the flow value of the corresponding GL-24 M input.

- **Description:** Alphanumeric type data which permits a brief description of the flow to be entered for better identification.
- **Unit:** Alphanumeric type data which permits a brief description of the units where the flow is shown to be entered.
- **Factor:** Multiplicative value of each input pulse.
- **Time:** Time in minutes for calculating the flow value.
- **Calculation window:** Time window, in seconds, that the software will use to calculate an estimate of the flow, taking into account the value of the device counter.

3.28.1.3 Variable limits



Only limits can be defined for flows that are enabled.

By means of this dialogue the nominal value of flow type counters, as well as a series of margins to display on screen when a variable measures unusual values can be configured.

The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits.

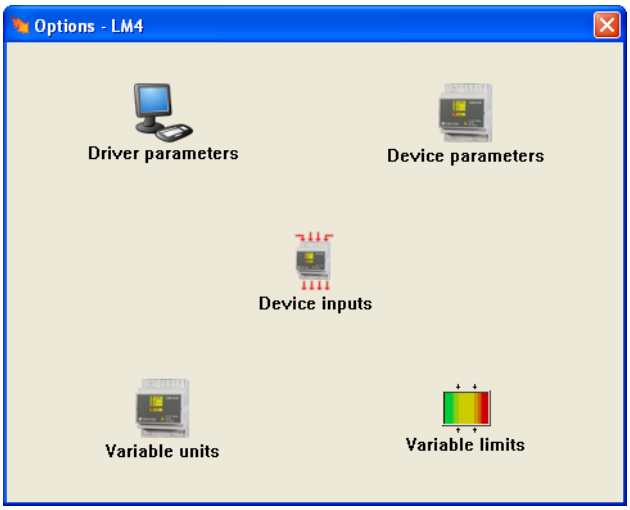
3.29 LM4I-4O-M

3.29.1 Driver options

The LM4I-4O-M options can be accessed from:

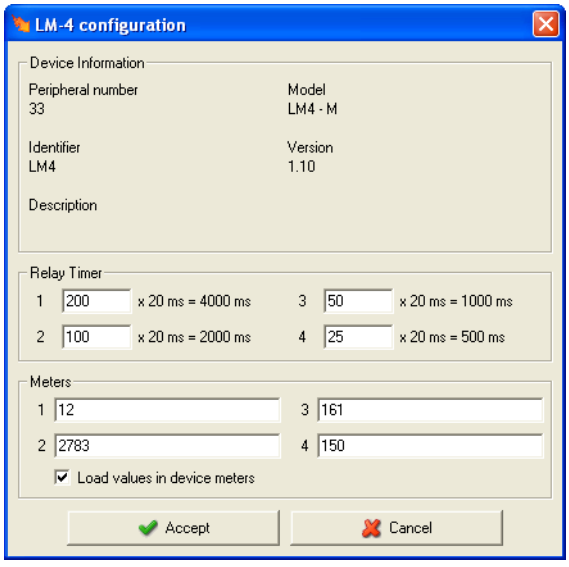
- *See Menu:* See section 2.4.3 Display options
- *Toolbar:* See section 2.4.4 Toolbar

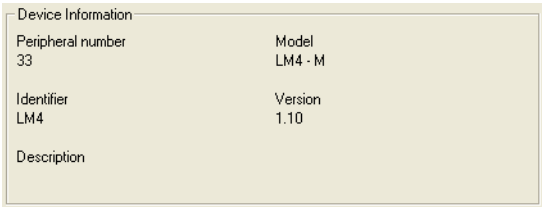
The following is the options menu:



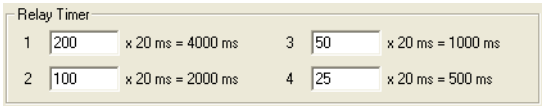
3.29.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

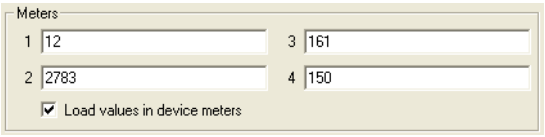




Shows general information.



Configuration of the pulse duration that can be generated with the digital outputs of the device.

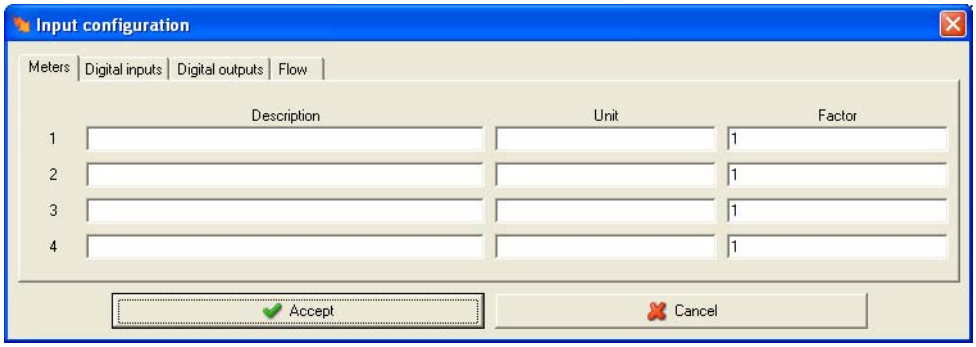


This part of the configuration corresponds to the device counters. If the selector , is checked, on sending the configuration the energy counter will be loaded with the values entered into the corresponding boxes.

3.29.1.2 Device inputs

For each of the inputs of the LM4I-4O-M, three variables will be available, a digital display to show the status of the input (open / closed), a counter variable to show the number of pulses detected at the input and finally a flow variable calculated by the software as an estimate of the pulse frequency on the input during a period of time.

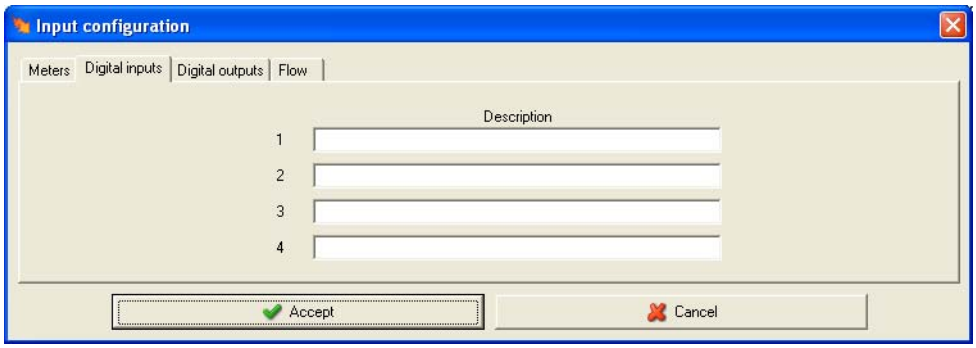
Using this dialogue the inputs and outputs of the LM4I-4O-M can be configured.



Using the ' Contadores | Entradas digitales | Salidas digitales | Caudales '; the display configuration of the different types of variables can be configured. The previous image shows the configuration of the counters, where:

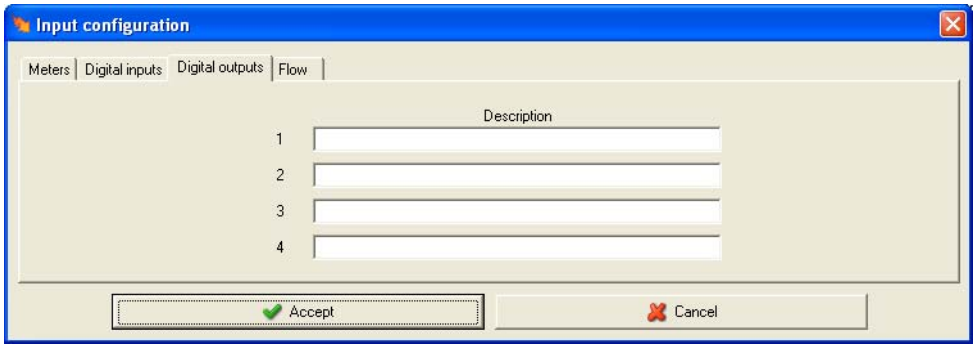
- **Description:** Alphanumeric type which permits a brief description of the counter so it can be identified better.
- **Unit:** Alphanumeric type data which permits a brief description of the units where the counter is displayed to be entered.
- **Factor:** Multiplicative value of each input pulse.

For digital inputs:



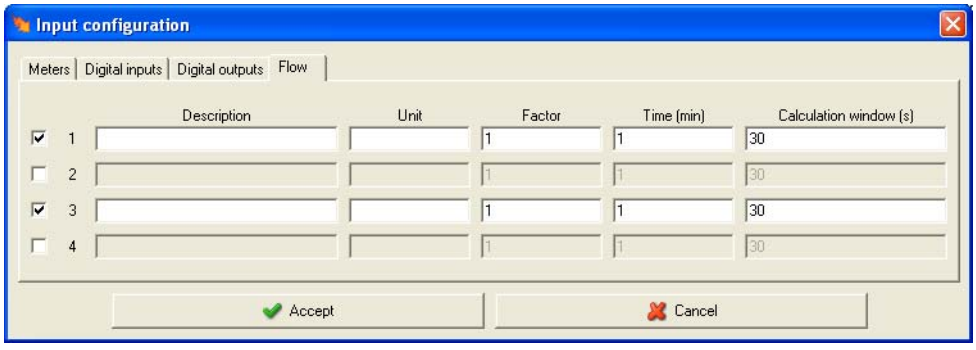
- **Description:** Alphanumeric type data which permits a brief description of the digital input to be entered for better identification.

For digital outputs:



- **Description:** Alphanumeric type data which permits a brief description of the digital output to be entered for better identification.

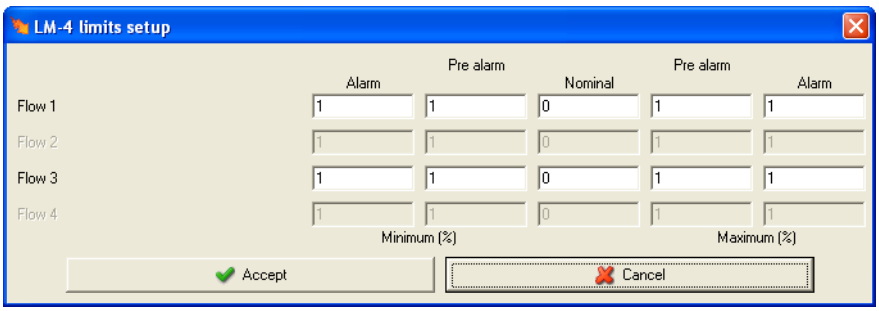
Finally for the flow configuration:



Checking the selector ☑; will activate the flow variable. Remember if this selector is not checked it will not be possible to view the flow value of the corresponding LM4I-4O-M input.

- **Description:** Alphanumeric type data which permits a brief description of the flow to be entered for better identification.
- **Unit:** Alphanumeric type data which permits a brief description of the units where the flow is shown to be entered.
- **Factor:** Multiplicative value of each input pulse.
- **Time:** Time in minutes for calculating the flow value.
- **Calculation window:** Time window, in seconds, that the software will use to calculate an estimate of the flow, taking into account the value of the device counter.

3.29.1.3 Variable limits



Only limits can be defined for flows that are enabled.

Through this dialogue the nominal value of flow type counters, as well as a series of margins to display on screen when a variable measures unusual values can be configured.

The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits.

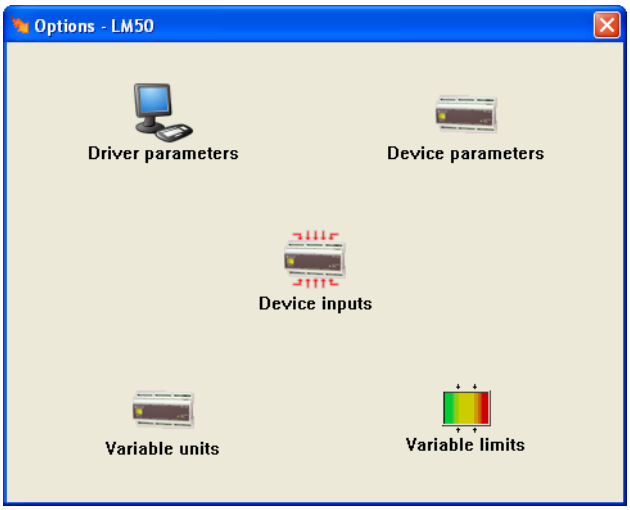
3.30 LM50-TCP

3.30.1 Driver options

You can access the LM50-TCP options from:

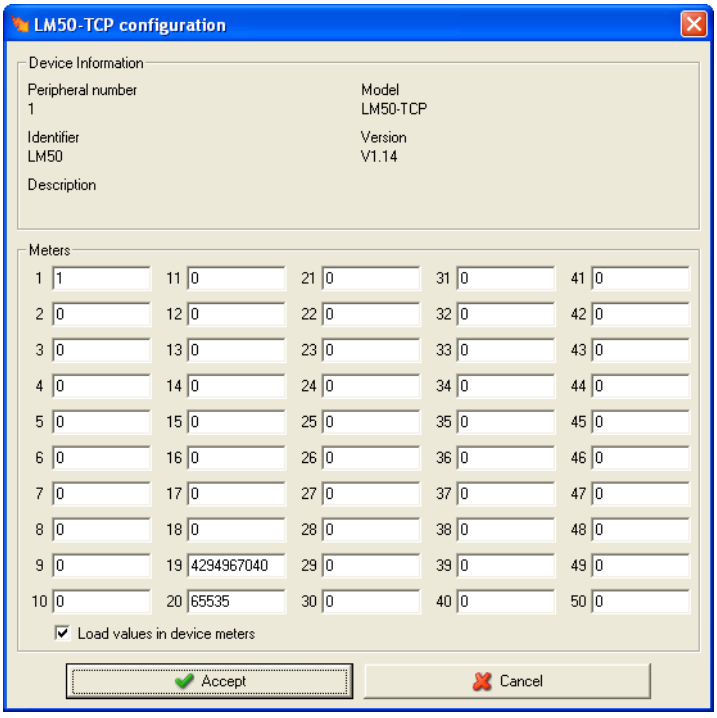
- *See Menu:* See section 2.4.3. Display options
- *Toolbar*: See section 2.4.3. Toolbar

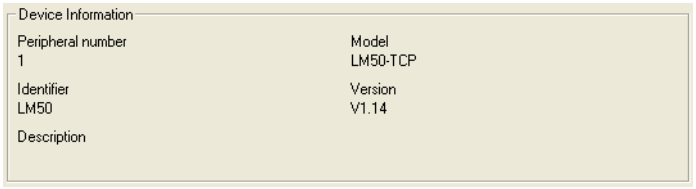
The following is the options menu:



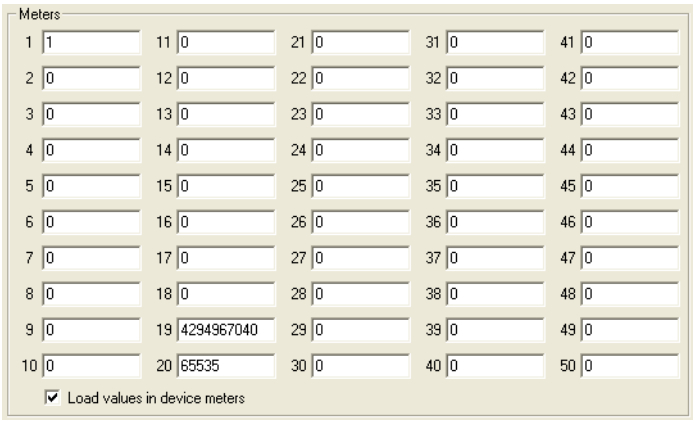
3.30.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.





Shows general information:

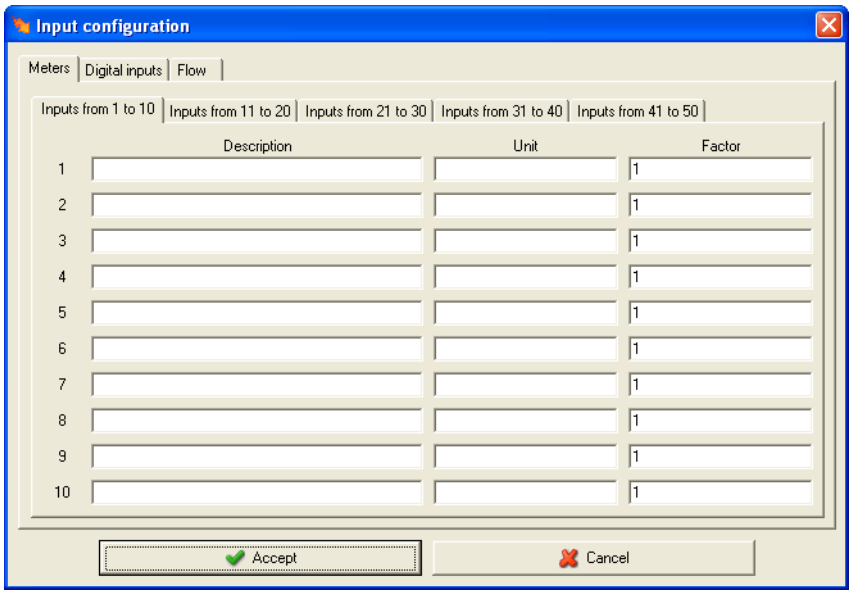


This part of the configuration corresponds to the device counters. If the selector is checked, on sending the configuration the counters, which have been modified, will be loaded with the values entered into the corresponding boxes.

3.30.1.2 Inputs

For each of the LM50-TCP inputs three variables will be available, a digital one to show the input status (open / closed), a counter variable to show the number of pulses detected in the input and finally a flow variable calculated by the software as an estimate of the pulse frequency that occurs in the input during a period of time.

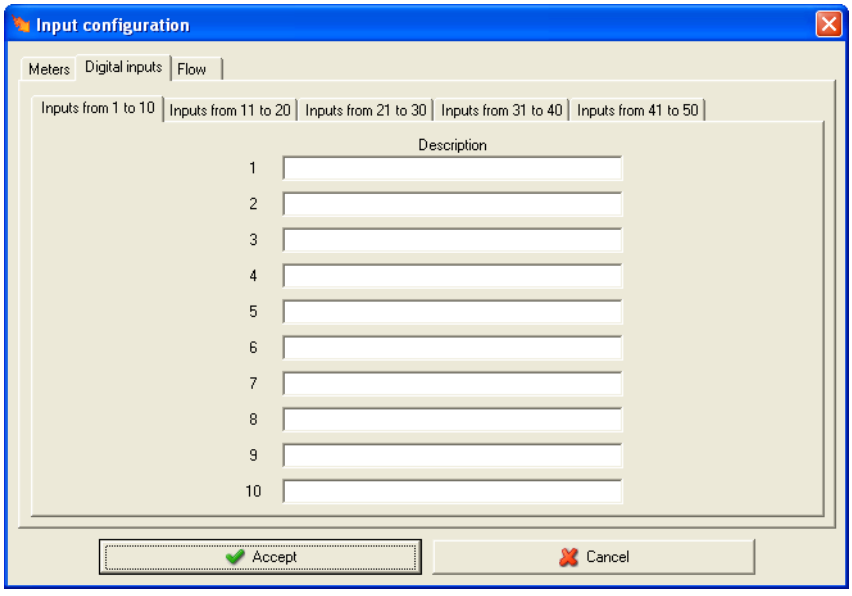
By means of this dialogue the LM50-TCP input can be configured.



Using the ' Contadores | Entradas digitales | Caudales ; the configuration display of the different types of variables can be configured. The previous image shows the configuration of the counters, where

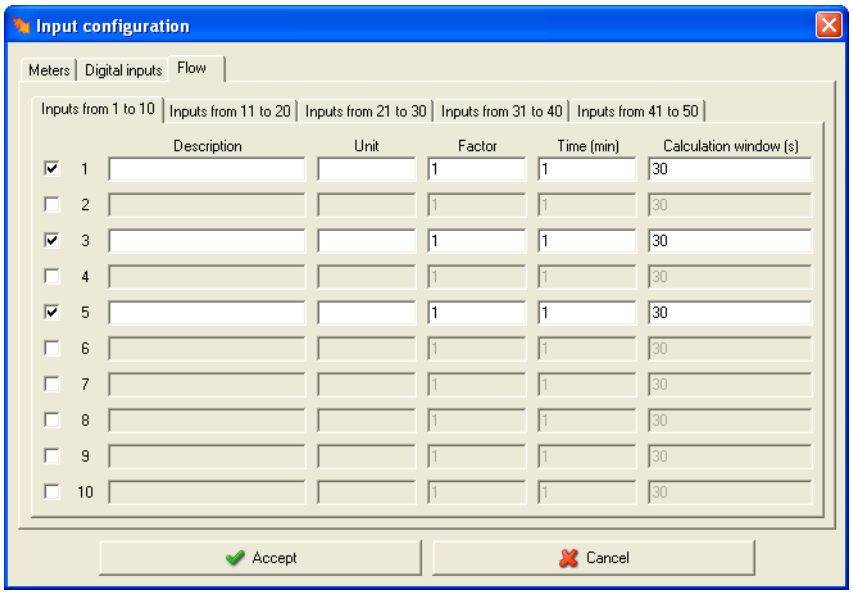
- **Description:** Alphanumeric type which permits a brief description of the counter so it can be identified better.
- **Unit:** Alphanumeric type data which permits a brief description of the units where the counter is displayed to be entered.
- **Factor:** Multiplicative value of each input pulse.

For digital inputs:



- **Description:** Alphanumeric type data which permits a brief description of the digital input to be entered for better identification.

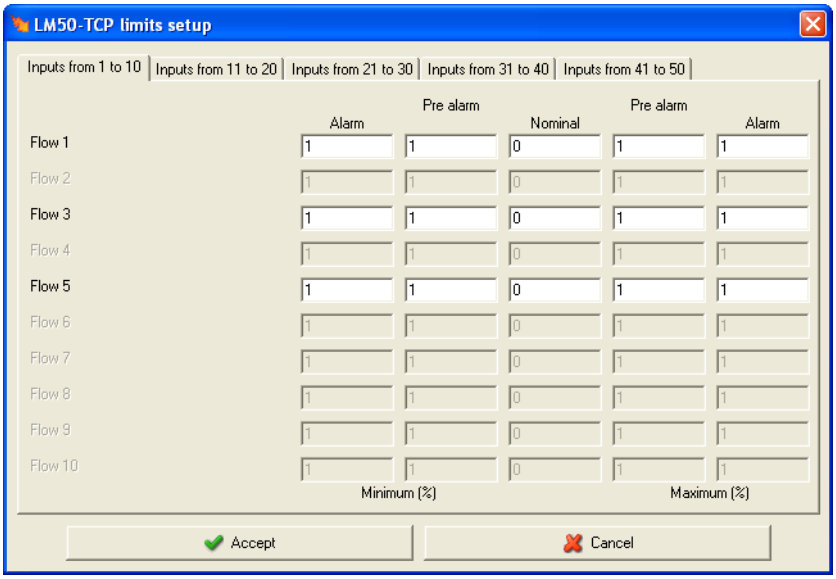
Finally for the flow configuration:



Checking the selector ☑ will activate the flow variable. Remember that if this selector is not checked it will not be possible to display the flow value of the corresponding LM50-TCP input.

- **Description:** Alphanumeric type data which permits a brief description of the flow to be entered for better identification.
- **Unit:** Alphanumeric type data which permits a brief description of the units where the flow is shown to be entered.
- **Factor:** Multiplicative value of each input pulse.
- **Time:** Time in minutes for calculating the flow value.
- **Calculation window:** Time window, in seconds, that the software will use to calculate an estimate of the flow, taking into account the value of the device counter.

3.30.1.3 Variable limits



Limits can only be defined on flow type counters.

By means of this dialogue the nominal value of flow type counters, as well as a series of margins to display on screen when a variable measures unusual values will be configured.

The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits

3.31 MKD

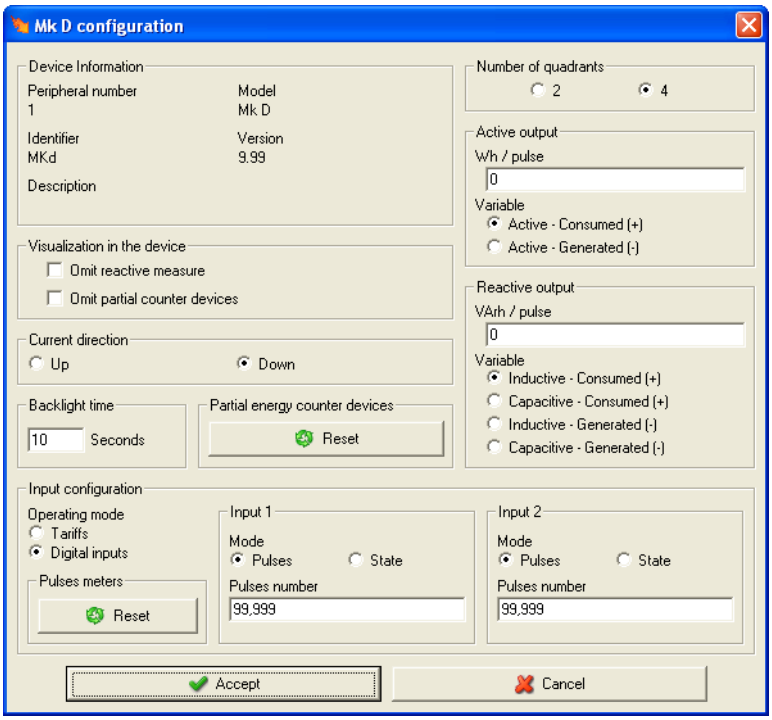
3.31.1 Driver options

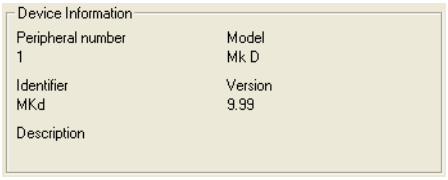
The following is the options menu:

The option ‘Variable units’ is detailed in section 3.1.2 *‘Variable units”*

3.31.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

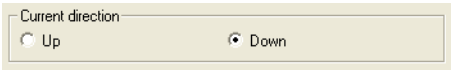




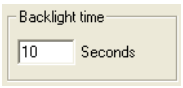
Shows general information.

Visualisation on the screen of the device.

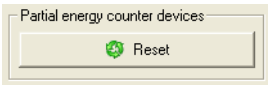
- **Omit reactive measurement:** The reactive measurements are not shown on the device screen, although they will be continue to be visualised on the software display screens.
- **Omit partial counters:** Partial counter measurements are not shown on the screen of the device nor on the display screens of the software.



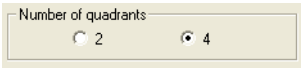
Flow direction



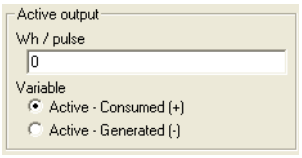
Configuration of the "*backlight*" disconnection. The value should oscillate between 0 and 10 seconds.



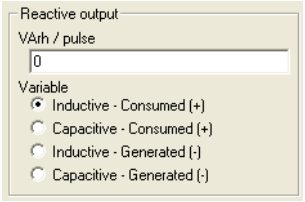
On clicking the button all the partial counters of the device will be started.



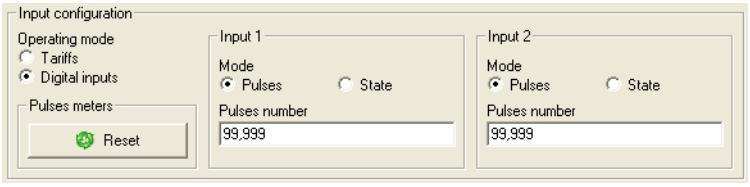
Configuration of the number of quadrants. With only 2 quadrants the consumed energy counters will be taken into consideration and with 4 the consumed and generated energy quadrants.



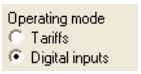
Configuration of the output relay of the active energy. The number of Wh equivalent to an output impulse and the variable that will be a measured to give this pulse. If the pulse value is 0, the output will be treated like a standard digital output, enabling its value to be forced from 0 to 1.



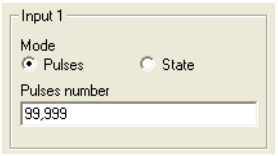
Configuration of the output relay of the reactive energy. The number of VArh equivalent to an output pulse and the variable that will be a measured to give the pulse can be configured. If the pulse value is 0, the output will be treated like a standard digital output, enabling its value to be forced from 0 to 1.



Configuration of the digital inputs of the device.



The inputs may be used as inputs for changing the tariff or as digital inputs. Consult the device manual for more information on how changing the tariff works



Configuration of one of the inputs when the operating mode is digital inputs. Inputs may be treated as pulse counters by selecting the 'Pulse' mode; the parameter '*number of pulses*' will correspond to the multiplicative factor of pulses counted at the input. When the selected mode is 'Status' it will show the input status, open or closed, and will disable the corresponding counter.

Clicking this button will reset the device counter. As long as the working mode is digital inputs and the input mode is configured in pulses.

3.32 MK-LCD

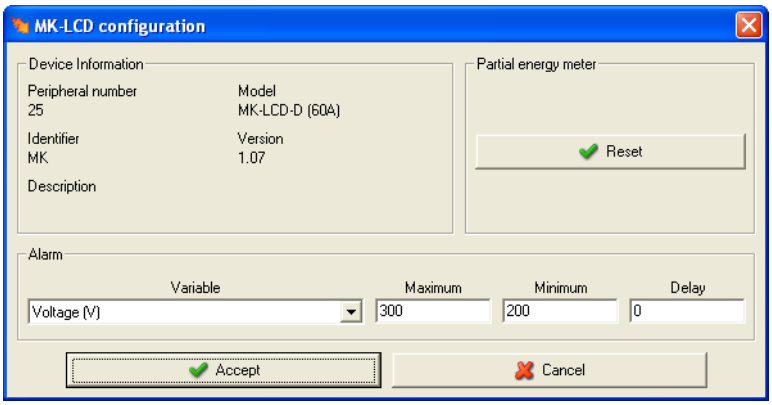
3.32.1 Driver options

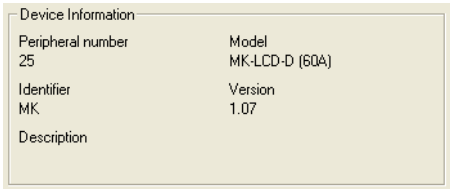
The following is the options menu:

The options "Variable Units" and "Variable Limits" are detailed in sections 3.1.2 Variable units and 3.1.3 Variable limits.

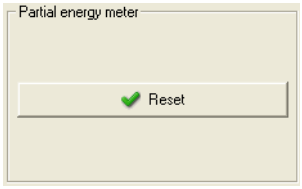
3.32.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

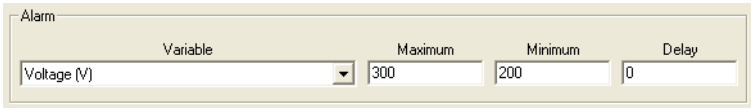




Shows general information.



By clicking the button the partial power counter will be set to zero.



This section shows the configuration of the device relay output and the option to configure it with the desired values is given.

- **Variable:** The parameters associated with the relay are indicated in this field. The output is programmed as an alarm, and any of the parameters measured by the device can be controlled. The units in which the maximum and minimum values of the alarm are expressed are indicated in brackets.

- **Max:** In this box the maximum value to control is indicated.

- **Min:** In this box the minimum value to control is indicated.

- **Delay:** Alarm delay in seconds. The maximum value is 9999 seconds.

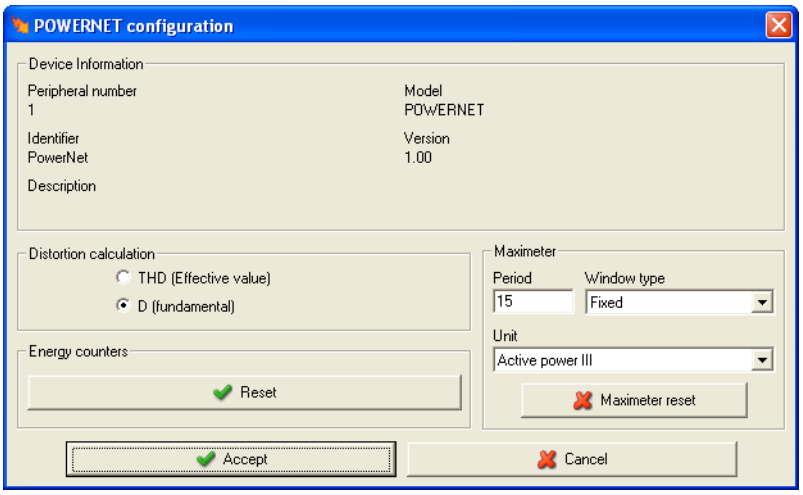
3.33 POWERNET

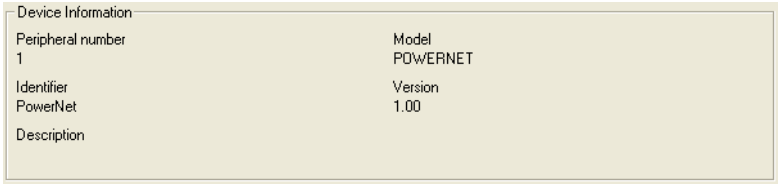
3.33.1 Driver options

The following is the options menu:

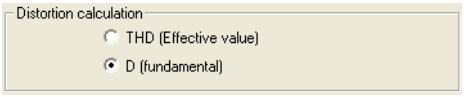
3.33.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

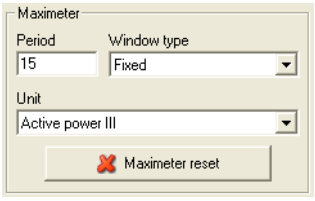




Shows general information.



Using this selector the type of distortion that the device will calculate can be configured.



- **Period:** Is the integration period of the maximeter that can oscillate between 1 and 60 minutes.
- **Type of window:** Type of window used to save the maximeter value, it can be fixed or sliding.
- **Unit** The maximum demand can be calculated with active power III, apparent power III, current III or current by phase depending on the device.
- **Maximeter reset:** When the button is enabled, the device maximeter goes to zero.

On clicking the button the energy counters on the device will return to zero.

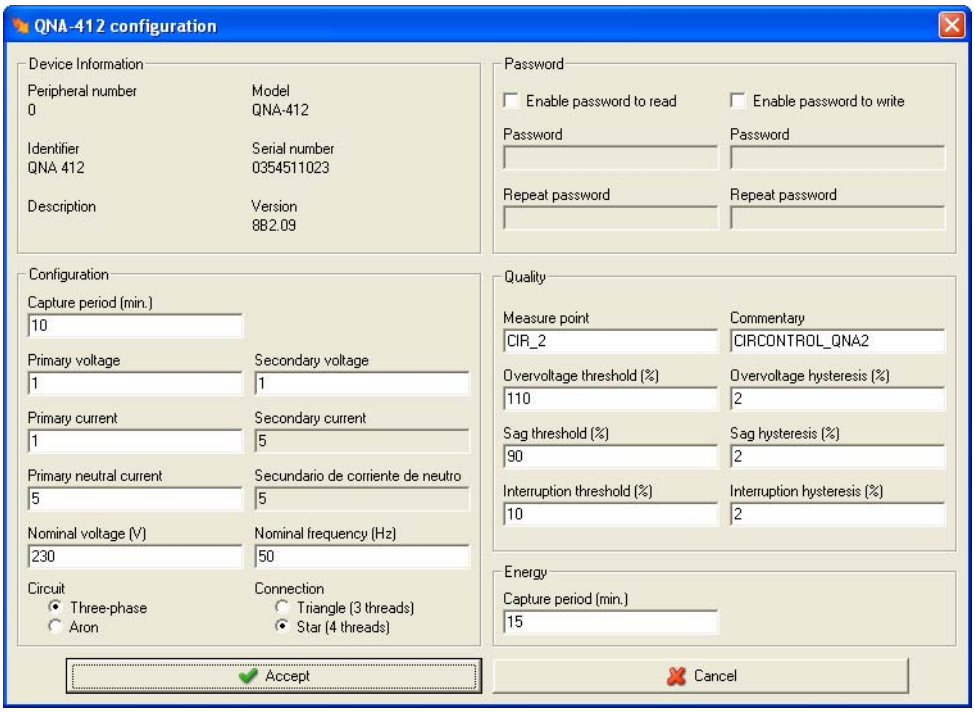
3.34 QNA 412/413

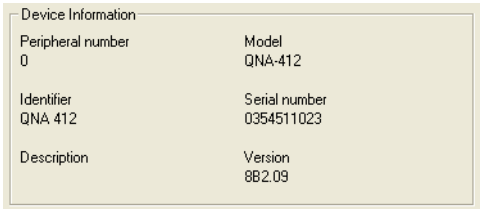
3.34.1 Driver options

The following is the options menu:

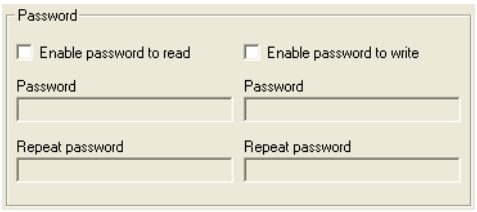
3.34.1.1 Device parameters

This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

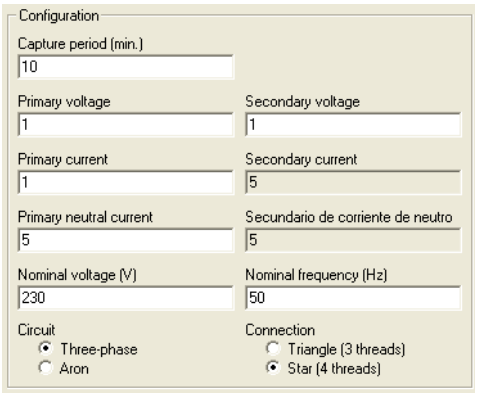




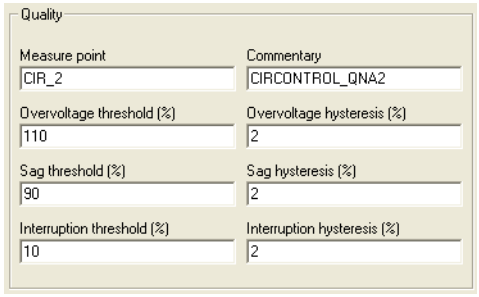
Shows information on the device.



Allows the password to be enabled or disabled to block both the reading and writing values and the configuration of the device.



- **Capture period:** Configuration in minutes between records stored on the device.
- **Primary voltage:** Device primary voltage value.
- **Secondary voltage:** Device secondary voltage value.
- **Primary current:** Device primary current value.
- **Secondary current:** Device secondary current value.
- **Neutral primary current:** Device neutral primary current value.
- **Neutral secondary current:** Device neutral secondary voltage value.
- **Rated voltage:** Rated voltage of the equipment, with a 3-wire configuration the composite voltage should be programmed and the single voltage on four wires. If the measurement is carried out through voltage transformers, the programmed value must refer to the secondary.
- **Nominal frequency:** Nominal frequency of the device.
- **Circuit:** Enables the type of circuit to which it is connected to carry out the measurement to be chosen, whether it is connected to a three-phase device or if it only uses two current connectors for the measurement (Aron).
- **Connection:** Enables the type of connection to which it is connected to carry out the measurement to be chosen, albeit delta (connection between phases, without neutral) or star (3-phase connection and neutral)



- **Measurement point:** Brief description of the measurement point where the QNA is situated
- **Comments:** Brief description of the measurement point.
- **Overvoltage threshold:** Serves to programme the overvoltage percentage. Each semi-cycle with an efficient value exceeding this value will be understood as over voltage.
- **Overvoltage hysteresis:** Overvoltage hysteresis is where the start-up voltage is different from the end voltage of overvoltage. An overvoltage will start when the voltage threshold value is exceeded and will finish when it is lower than the value defined by the difference between the threshold and the hysteresis.
- **Gap threshold:** Serves to programme the gap detection. Each semi-cycle with an efficient value not reaching this defined value will be understood as a gap.
- **Gap Hysteresis:** Will define a gap hysteresis so that the initial voltage is different to the end of gap voltage. A gap will start when the voltage does not exceed the threshold value and will finish when this is lower than the value defined by the sum of the threshold and the hysteresis.
- **Threshold interruption:** defined as power off (absence of tension, interruption) the voltage drop below the value set.
- **Hysteresis interruption:** A hysteresis of interruption is when the start-up voltage is different from the voltage interruption end. An interruption will begin when the voltage does not exceed the threshold value and ends when it exceeds the value defined by the sum of the threshold and hysteresis interruption.

Enables us to specify the energy capture time expressed in minutes.

3.35 RGU-10 / RGU-10 RA

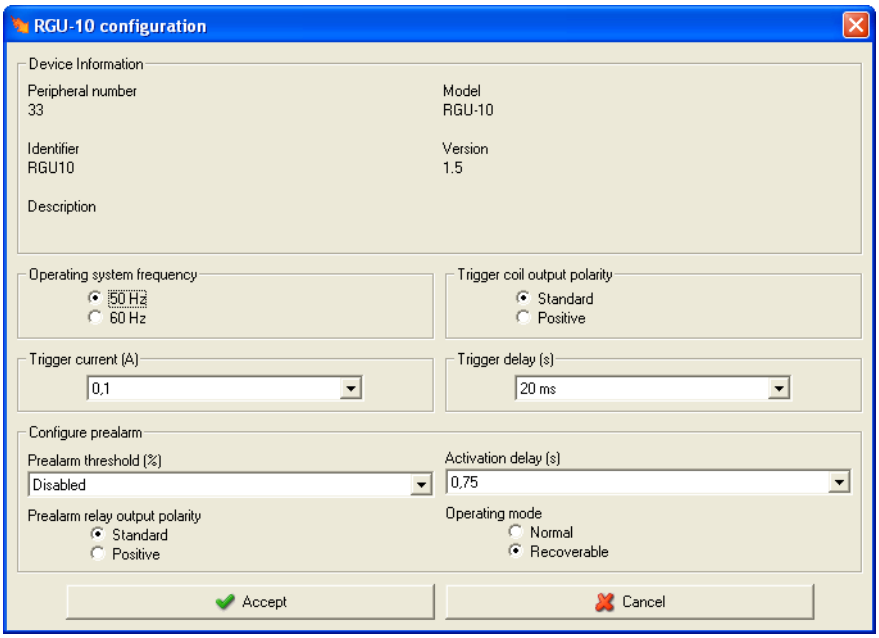
3.35.1 Driver options

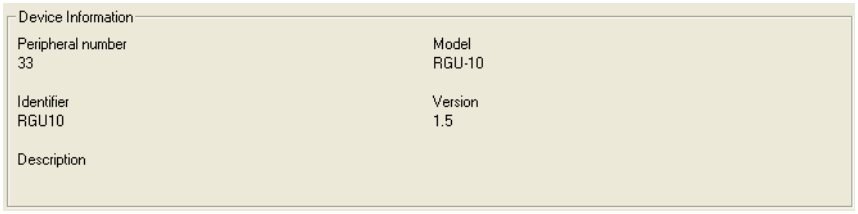
The following is the options menu:

3.35.1.1 Device parameters

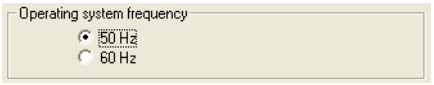
This screen allows the internal parameters of the device to be configured. On opening the dialogue box, the software will read the configuration of the device. When complete, click on "Accept" for the software to send information on changes to the device. In no case will the information be stored on the hard drive of the PC.

3.35.1.1.1 RGU-10

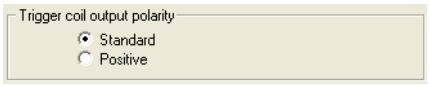




Shows general information.



Configuration of the frequency of the operating system.



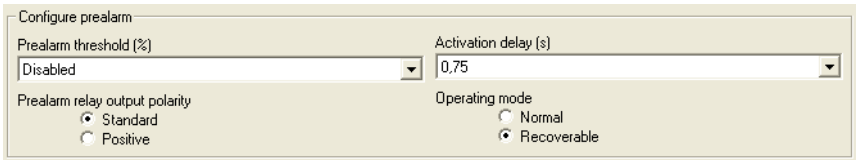
Configuration of the polarity of the trigger coil relay output, allowing one of the two possible options to be selected (standard or positive).

Configuration of the channel trigger threshold. It will be possible to select one of the following values:

0.03 A	0.1 A	0.3 A
0.5 A	1 A	3 A
5 A	10 A	30 A

Enables the trigger delay time from one of the following values to be selected:

Instantaneous	Selective	20 ms
100 ms	200 ms	300 ms
400 ms	500 ms	750 ms
1 s	3 s	5 s
10 s		



It will be possible to configure the pre-alarm following parameters:

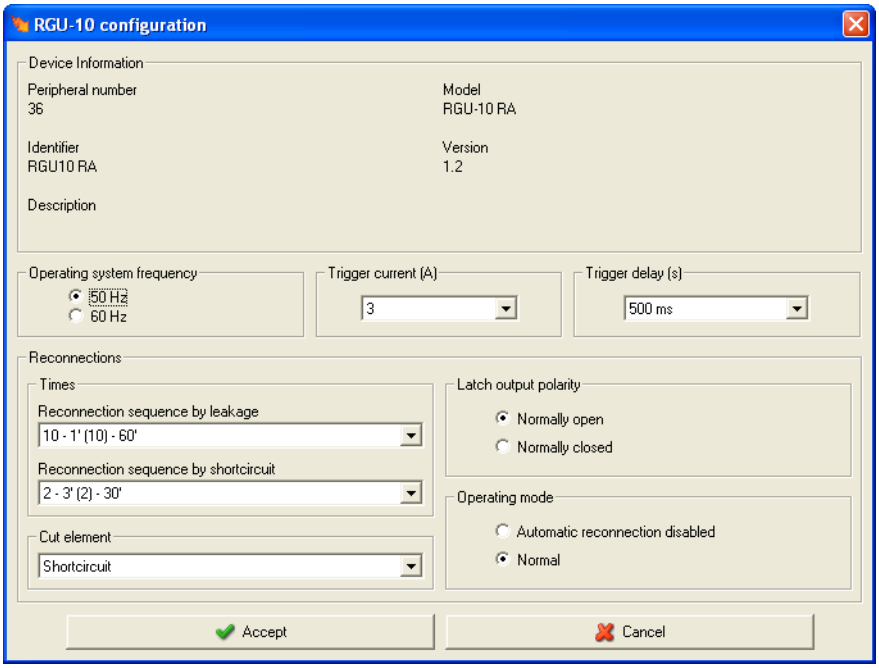
- *Pre-alarm threshold.* Where can % of the nominal current can be defined to activate the pre-alarm, this value will vary between 50 and 90%.
- *Delay time on activation.* Enable the time delay in activating the pre-alarm to be selected from among the following values:

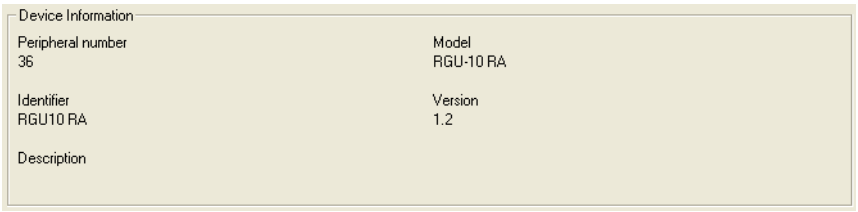
0.02 s	0.10 s	0.20 s
0.30 s	0.40 s	0.50 s
0.75 s	1.00 s	3.00 s

5.00 s	10.00 s	

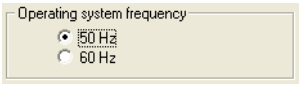
- *Polarity of the pre-alarm relay output.*
- *Pre-alarm operating mode.*

3.35.1.1.2RGU-10 RA

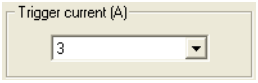




Shows general information.



Configuration of the frequency of the operating system.

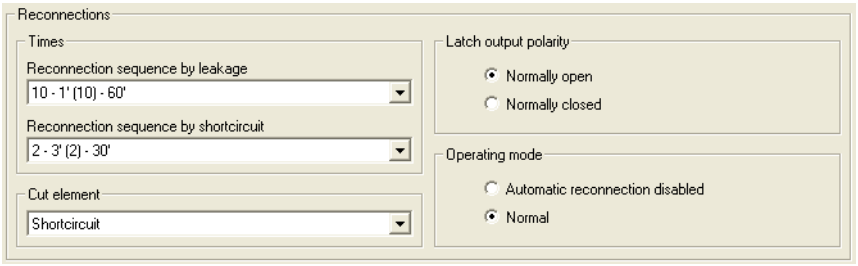


Configuration of the channel trigger threshold. It will be possible to select one of the following values:

0.03 A	0.1 A	0.3 A
0.5 A	1 A	3 A
5 A	10 A	30 A

Enables the trigger delay time to be selected from one of the following values:

Instantaneous :	Selective	20 ms
100 ms	200 ms	300 ms
400 ms	500 ms	750 ms
1 s	3 s	5 s
10 s		



It will be possible to set the following reclosure parameters:

- *Residual current device reclosure Sequence.* Enables one of the following values to be selected

No. reclosure	Sequence times	Reset time
6	8, 16, 30, 59, 115 and 224 seconds	15 minutes
30	20, 40 seconds and 5 minutes for the rest	15 minutes
8	30 seconds, 1, 2, 3, 4, 5, 6 and 7 minutes	15 minutes
6	10,20,30,60,130 and 600 seconds	5 minutes
6	2, 4 and 8 minutes for the rest	15 minutes
6	30 seconds, 1, 2, 3, 4, 8 and 16 minutes	15 minutes
10	1 minute between reclosures	30 minutes
10	90 seconds between reclosures	30 minutes
6	2, 4, 6, 6, 6 and 6 minutes	15 minutes
10	3 minutes between reclosures	30 minutes
10	1 minute between reclosures	60 minutes
10	90 seconds between reclosures	60 minutes
6	8 seconds between reclosures	15 minutes

The information shown will be xx – yy – zz, where xx corresponds to the number of reclosures, yy to the sequence of time and zz to the reset time.

- *Circuit breaker reclosure. Allows one of the following values to be selected.*

No. reclosure	Sequence times	Reset time
Reclosure disabled		
2	1 minute between reclosures	30 minutes
2	1 minute between reclosures	60 minutes
2	90 seconds between reclosures	30 minutes
2	90 seconds between reclosures	60 minutes
2	3 minutes between reclosures	30 minutes
2	30 seconds between reclosures	30 minutes
6	30 seconds between reclosures	30 minutes

The information shown will be xx – yy – zz where xx corresponds to the number of reclosures, yy to the sequence of time and zz to the reset time.

- *Cut-off element.* Lets the type of cut off element be selected from one of the following values:

Switch

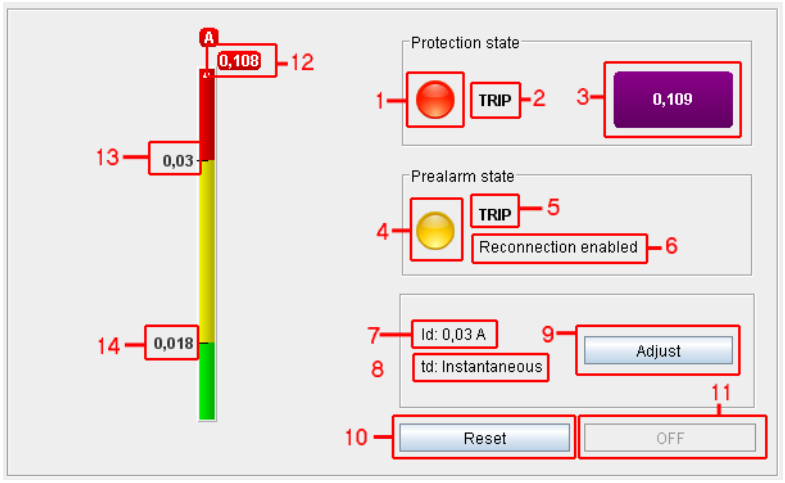
Circuit breaker
Circuit breaker + trigger coil

- *Polarity of the locking relay output.*
- *Operation mode.*

3.35.2 Displaying values

3.35.2.1.1RGU-10

The RGU-10 device will show the following screen values:

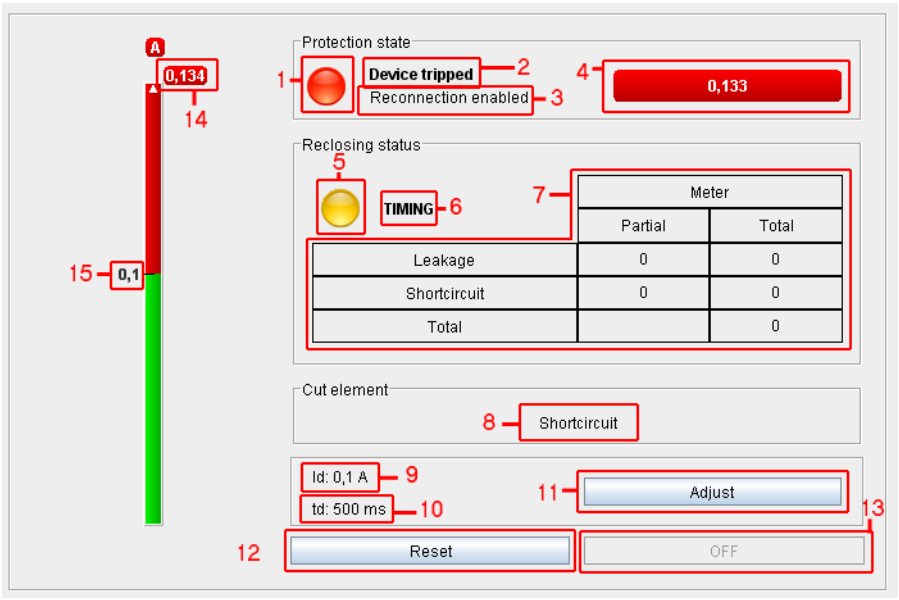


Where:

1. Protection status:
   - ♦ Not tripped.
   - ♦ Tripped.
2. Additional information on the protection status.
3. Leakage current value detected in the trigger channel. This information will be visible only when the channel is tripped.
4. Status of the pre-alarm:
   - ♦ Not enabled
   - ♦ Pre-alarm enabled
5. Additional information on the status of the pre-alarm.
6. Additional information on the pre-alarm reclosure. This will only appear when the automatic reclosure of the pre-alarm is enabled.
7. Information about the configured trigger current threshold
8. Information about the configured trigger time.
9. Adjustment button. Displays channel information and allows some parameters to be modified.
10. Reset button. If the channel is not tripped, the button will remain disabled. Push the button to restart the channel.
11. Off button. Enables remote triggering of the channel to be made. If the channel is tripped the button will remain disabled.
12. Value of instant leakage current. If the value exceeds the limits of the values bar, either over or under, an arrow below the value will indicate this).
13. Trigger threshold value configured for the channel
14. Pre-alarm value configured for the channel.

3.35.2.1.2 RGU-10 RA

The RGU RA-10 device will show the following value screen:



Where:

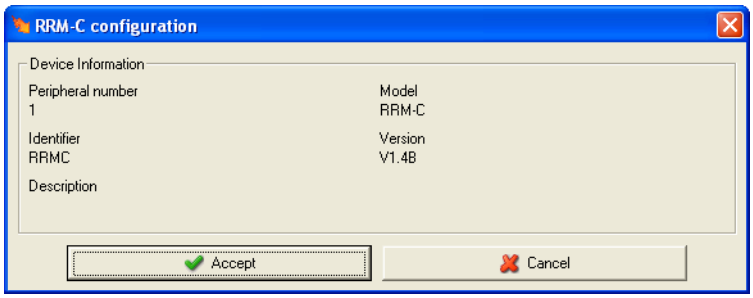
1. Protection status:
   - ♦ Not tripped
   - ♦ Tripped.
2. Additional information on the protection status.
3. Information that appears only when the reclosure is enabled
4. Leakage current value detected in the channel trigger. This information will be visible only when the channel is tripped.
5. Reclosure status or channel latching indicator
   - ♦ Normal
   - ♦ ←→ . Blinking. The device is timing the reclosure
   - ♦ . Fixed. The channel is locked.
6. Additional information on the interlocking status.
7. Table with the partial and total counter values.
8. Cut-off Element configured.
9. Information about the configured trigger current threshold
10. Information about the configured trigger time.
11. Adjustment button. Displays channel information and allows some parameters to be modified.
12. Reset button. If the channel is triggered, the button will remain disabled. Push the button to restart the channel.
13. Off button. Enables remote triggering of the channel to be made. If the channel is tripped the button will remain disabled.
14. Value of instant leakage current . If the value exceeds the limits of the values bar, both over or under, an arrow below the value will indicate this).
15. Trigger threshold value configured for the channel

3.36 RRM-C

This device does not keep a log, so it will not be possible to make graphs or tables of any parameter shown by the device.

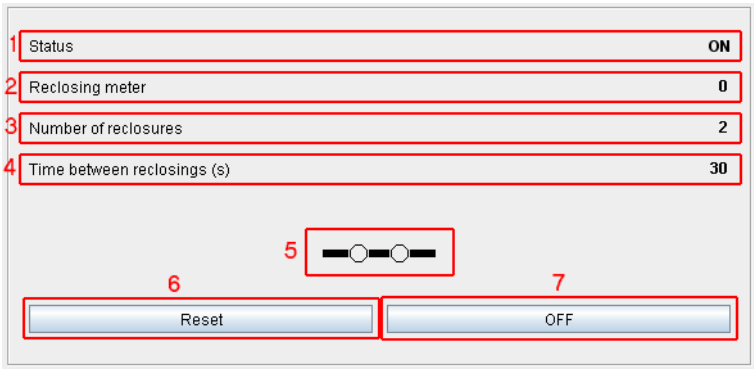
3.36.1 Driver options

Click on the "Options" buttons and information such as the model and the version of the device will be shown.



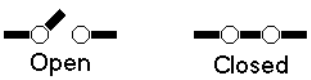
3.36.2 Displaying values

The RRM-C device will show the following value screen:



Where:

1. Displays the status of the device.
2. Shows the number of actual reclosures .
3. Number of reclosures configured on the device.
4. Time between reclosures configured on the device.
5. State of the device relay.



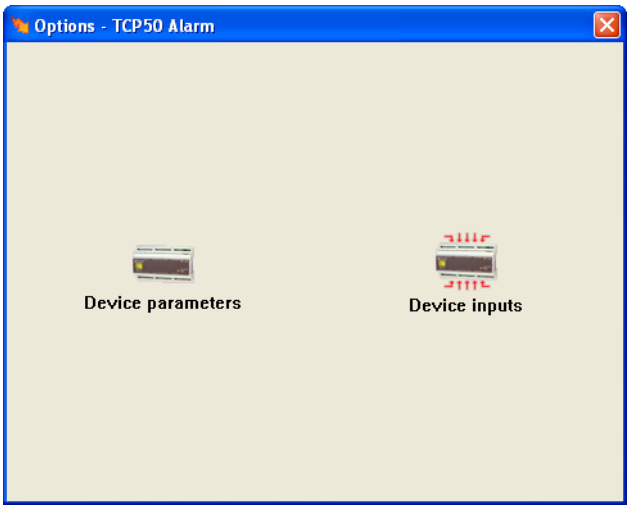
6. *Reset* button. Clicking the button resets the device.
7. *OFF* button. Clicking the button triggers the device.

3.37 TCP50 – ALARM

This device does not keep a log; therefore it is not possible to configure any device parameters.

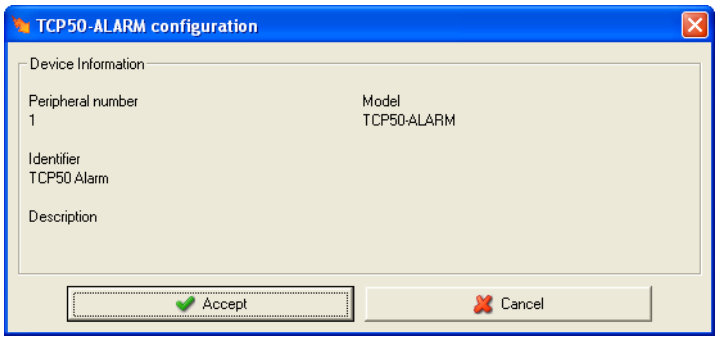
3.37.1 Driver options

The following is the options menu:



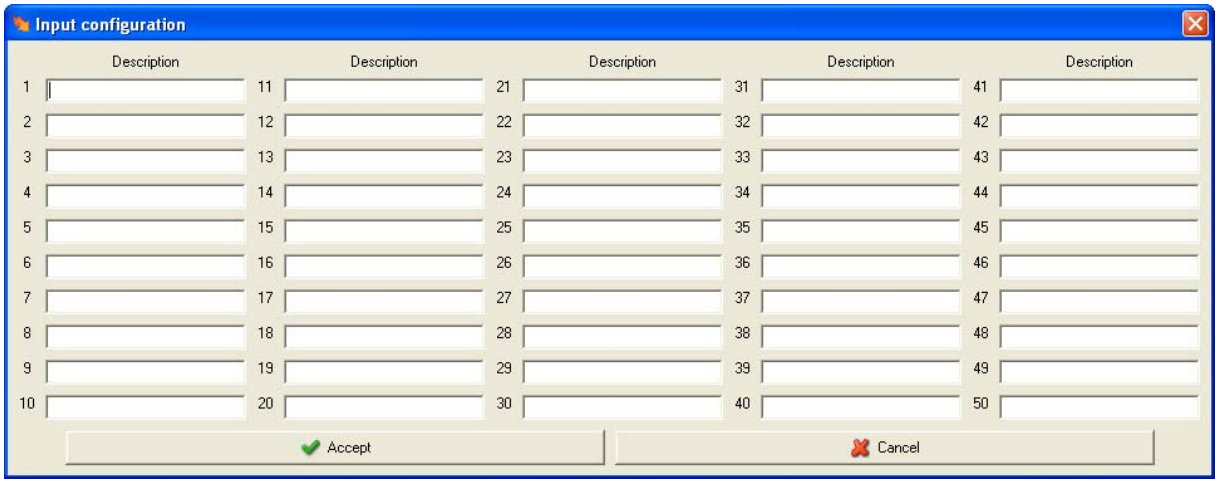
3.37.1.1 Device parameters

Click on the "Device Parameters" button and information will be shown about the device.

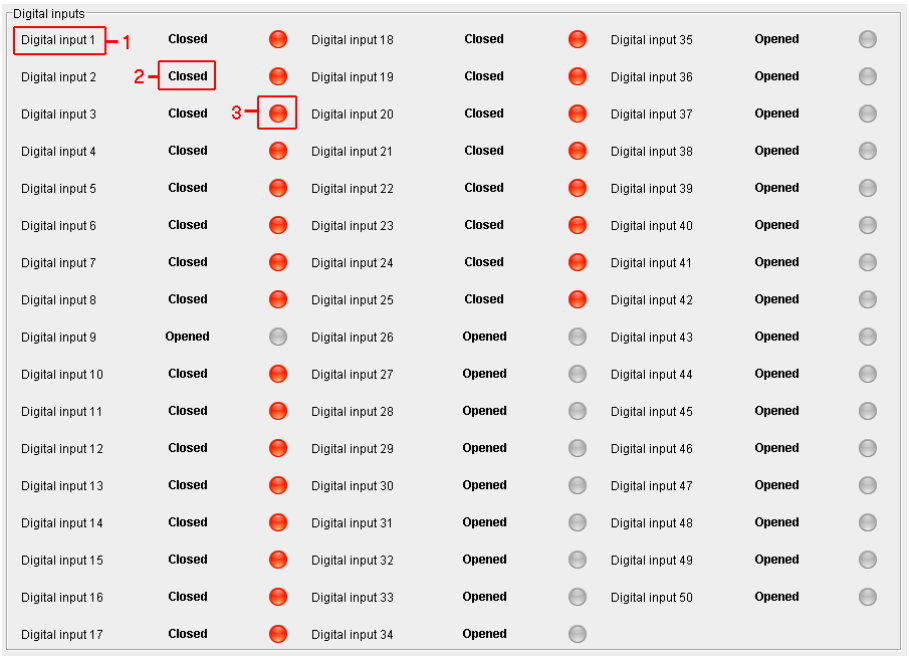


3.37.1.2 Device inputs

By means of this dialogue box a brief description of the device inputs can be entered for improved identification purposes.



3.37.2 Displaying values



1 Digital input number. Specifies the digital input in use.

2 Input status

Input Open
Input Closed

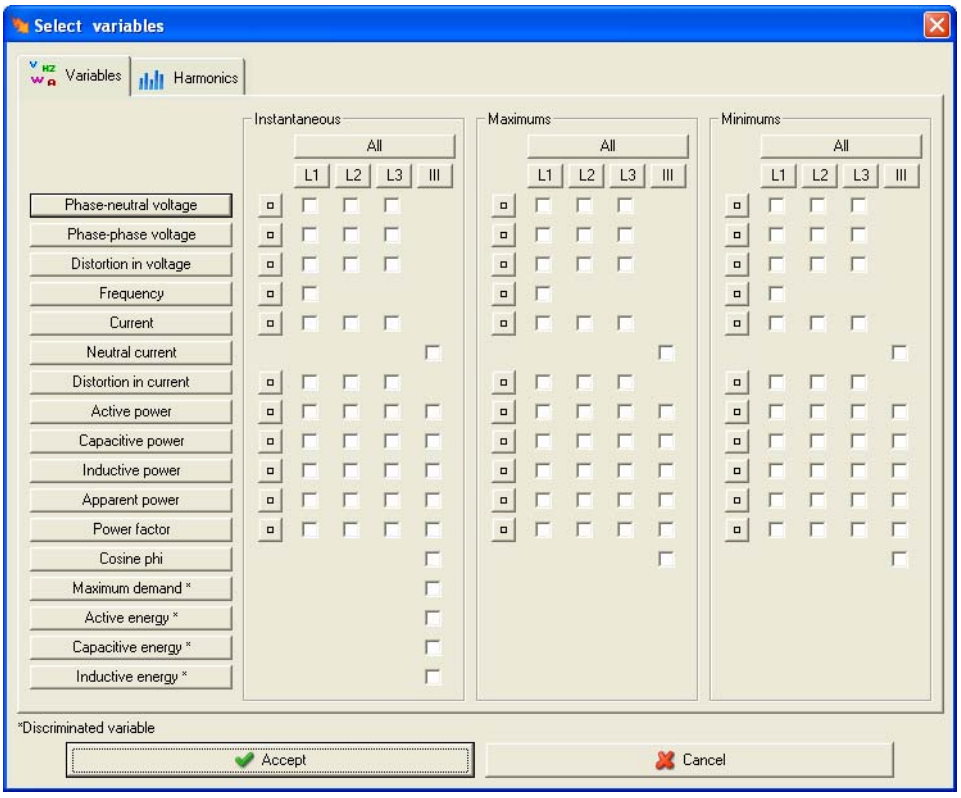
3 Input status

Open
Closed

4 Variable selection

Where necessary the selection of one or more variables of a device, the dialogue for variable selection will appear. It will be possible to select both analogue variables (voltage, current, power, etc...), as well digital variables on equipment which permits this.

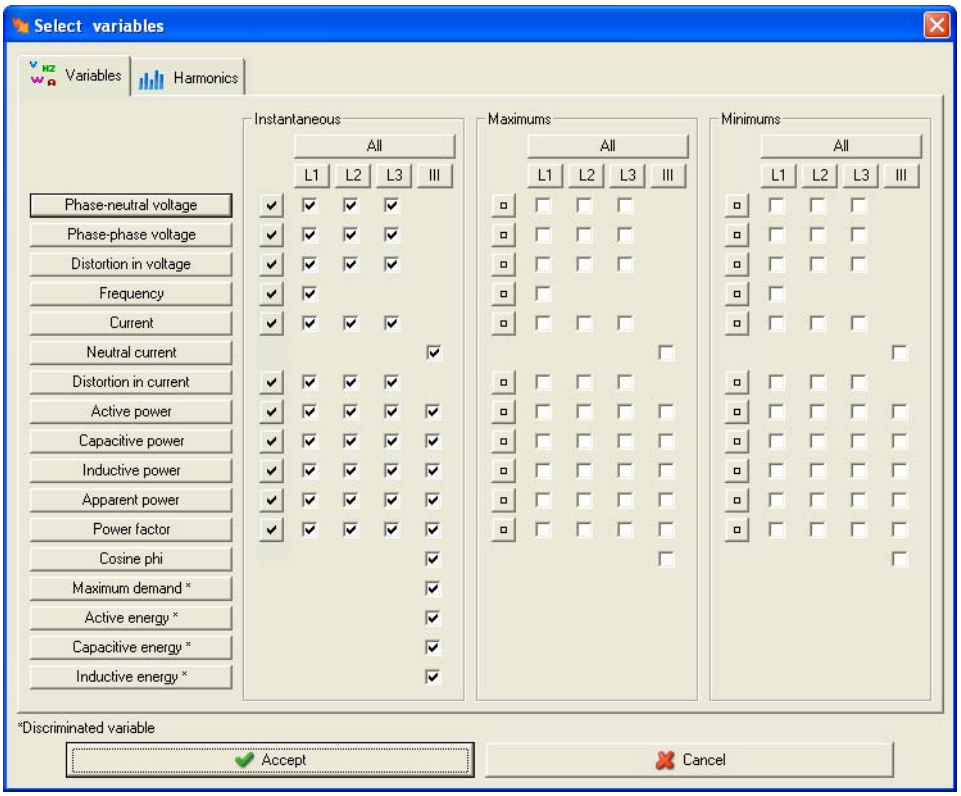
First the selection of analogue variables will be detailed. This dialogue will depend on the device connected, the explanation corresponding to CVM-96 can be used for this section.



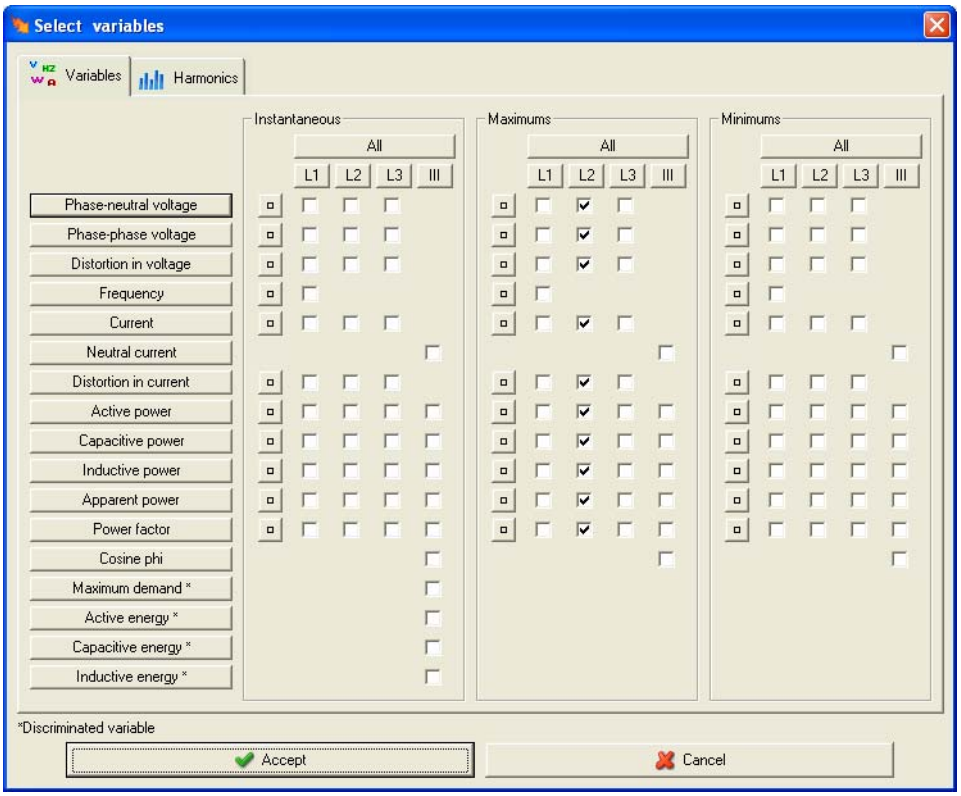
Where the variables we wish to select can be checked. If any variable is already selected it will appear marked as ☑, and may not be unchecked.

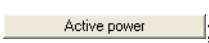
If a discriminator has been already selected, either by default or otherwise, the variables which can be discriminated will appear marked on the button as Active energy * and an explanation will appear on the lower part of the screen *Discriminated variable

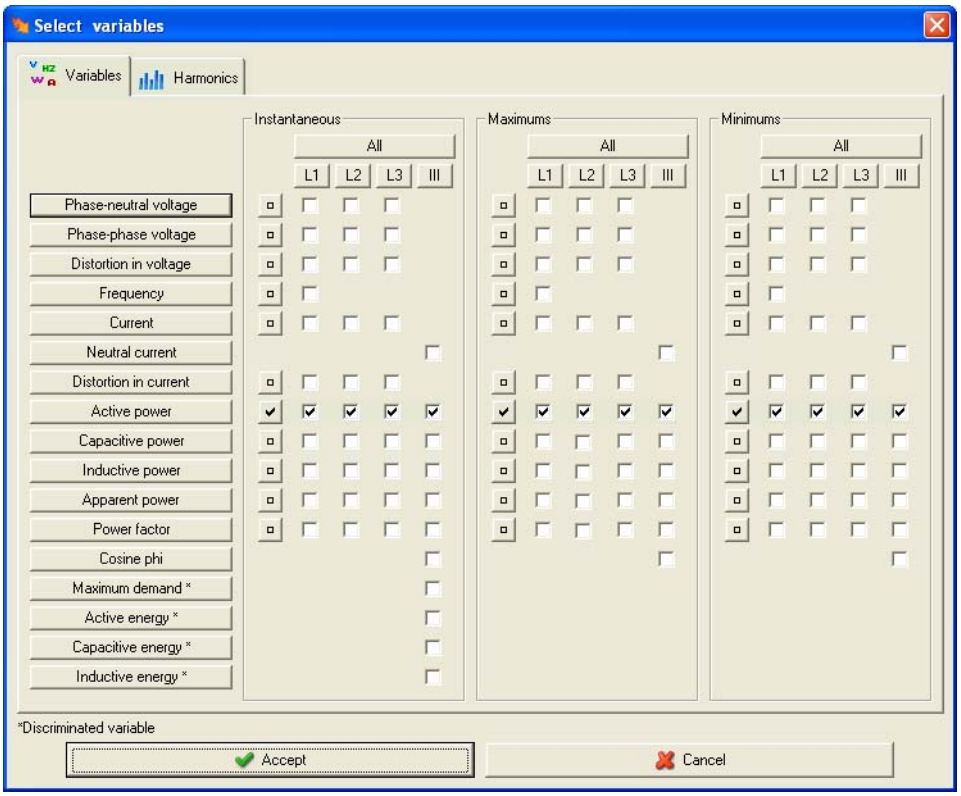
If the All button is clicked all the variables will be selected or deselected.



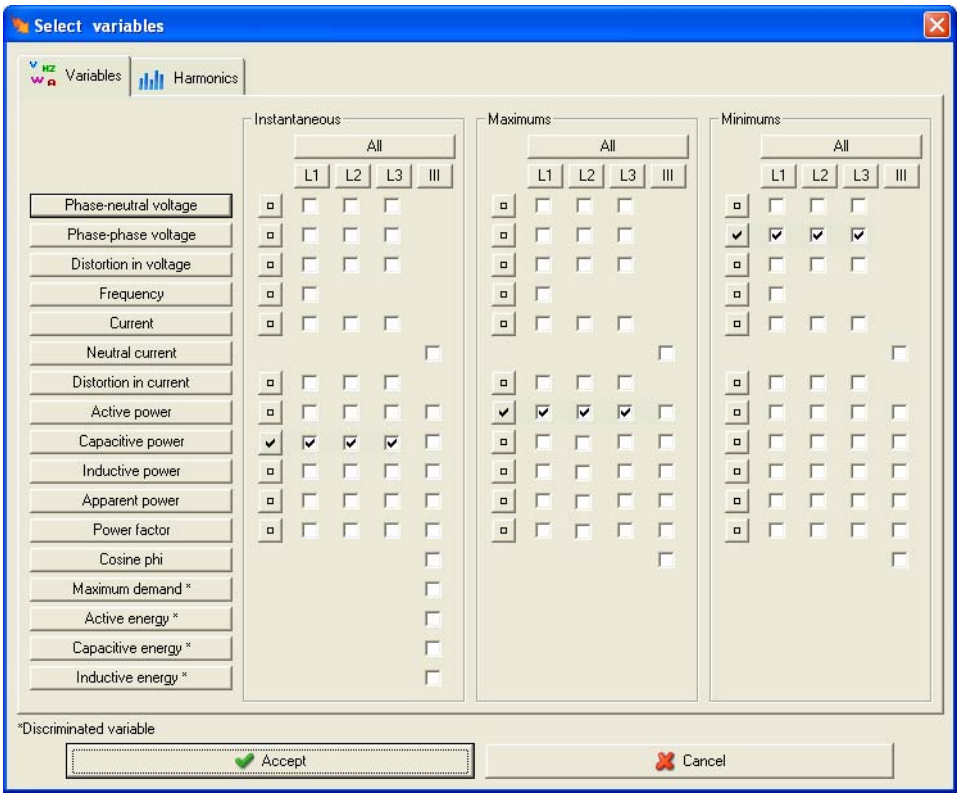
If you click on one of the stage buttons ; only the variables for this stage will be selected or deselected .



If you click on one of the variables, for example  ; all the boxes for this variable will be selected.



Finally, clicking on ▫; phases 1, 2 and 3, instant, maximum or minimum, are selected according to the button pressed. If all three phases are selected the button switches to ✔, and when pressed the 3 phases are deselected.



5 Discriminators

PowerStudio provides a complete set of tools that allow the definition of energy discriminators as well as further analysis and study on the data collected by the devices in both a powerful and intuitive manner.

A discriminator study provides a consistent result in an energy consumption representation for each type of hour (counter) defined at any moment. This representation can be displayed either as a table or graph.

Similarly it is possible to study this data displaying it at different time intervals or grouping it together in different periods. Therefore, we can see them in periods of a year and grouped together by months, in monthly intervals and grouped together by days, etc.

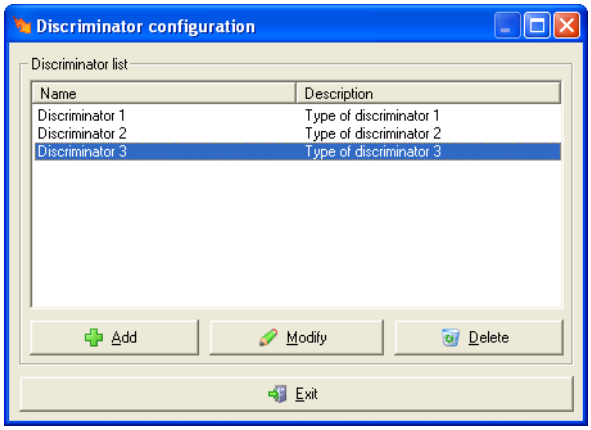
As can be seen the discriminator studies consist basically of defining the discriminators (typically a calendar) and applying said discriminator to the data stored in a device. Therefore a representation of the study realised can be obtained as the user desires (and visible both in graph and table format.)

5.1 Discriminator configuration

The first stage that is carried out is the configuration of the discriminators we want to apply to the data for analysis. The user can add new discriminators and delete or modify the existing discriminators.

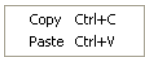
To manage these actions the option "Discriminators" should be selected from the "Set up" menu.

The following dialogue box will appear:



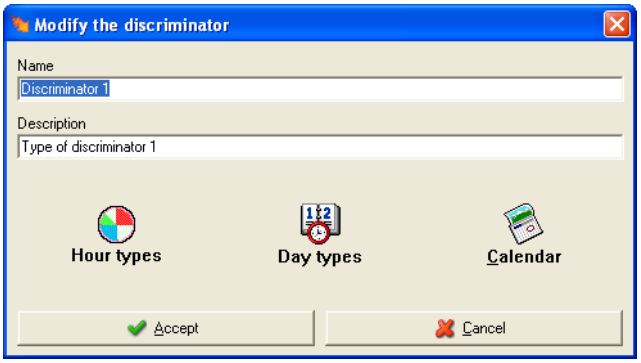
From where discriminators can be added, deleted or modified.

Clicking the right-button on the mouse over the list of discriminators the following contextual message will appear.



enabling discriminators to be pasted and copied. It may be possible that some of the options from the context menu do not appear, copy will only appear if there is a discriminator selected and the paste option only if the discriminators have been copied onto the clipboard. If no discriminator is selected and there are no discriminators on the clipboard when the right button is clicked the context menu will not appear.

When “Add” or “Modify”, from the dialogue box "Discriminator Configuration" is clicked the following dialogue box will appear:



Alphanumeric type data which enables the unique identification of the discriminator.

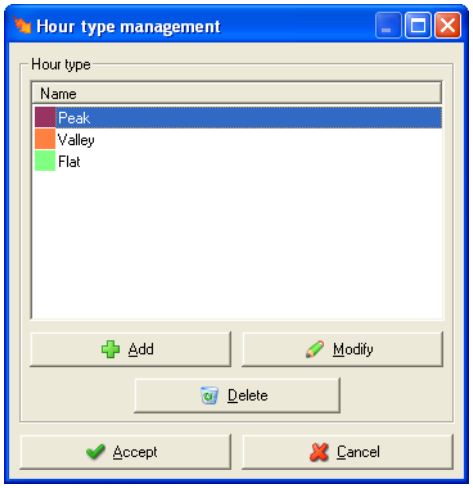
Alphanumeric type data which enables the user to enter a brief description of the discriminator.

Configures the different types of hours defined in the discriminator.

Configures the different types of days defined in the discriminator.

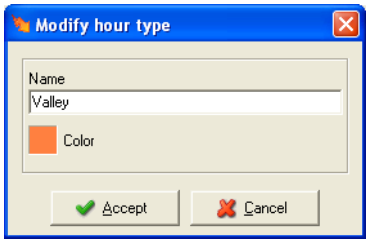
Configures the discriminator calendar.

5.1.1 Types of hours



Through this dialogue the different discriminator hour types may be added, deleted or modified. . These types of hour are the basic elements of the definition of the discriminators. Here the registered consumption is distributed in accordance with the calendar (maximum energy and demand).

Typically the types of hours correspond to the various prices that can be applied to the energy consumed in accordance with the time zone or day). When adding or modifying the following dialogue will appear:

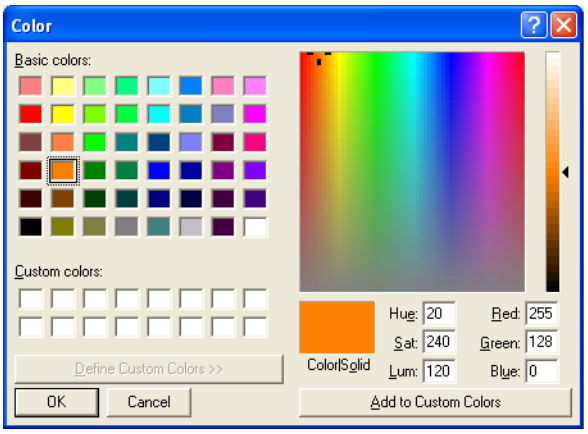


Where:

Alphanumeric type data which allows us to uniquely identify the type of hour within the tariff.

Colour that visually identifies the type of hour within the discriminator and will be used for the result graph of applying this discriminator to data stored by any device (all counters for the different maximum demand and energy variables).

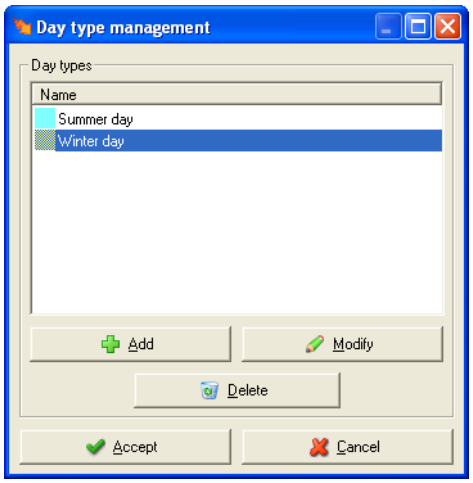
Clicking once with the left mouse button on the coloured box 1, the following dialogue appears where you can configure the colour for the type of day.



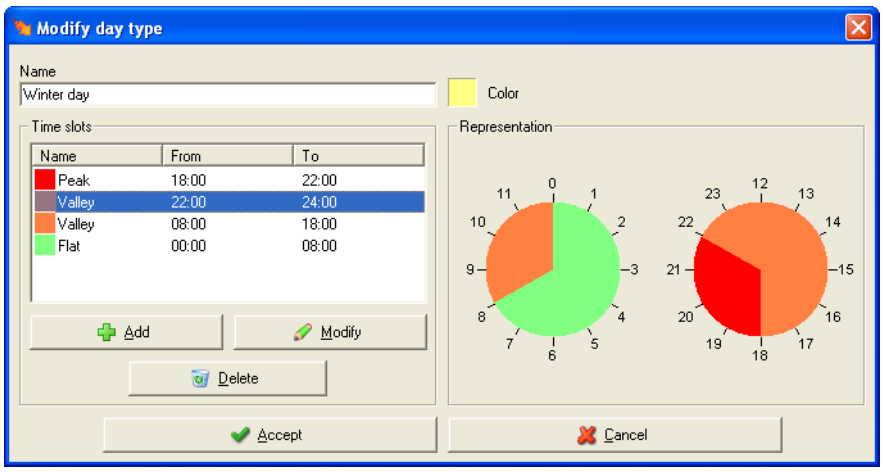
Clicking the “Delete” button, will delete all the types of hours selected from the list.

After defining the types of hours these will then be distributed throughout each day defining for them the different types of days which will make up our discriminator.

5.1.2 Types of day



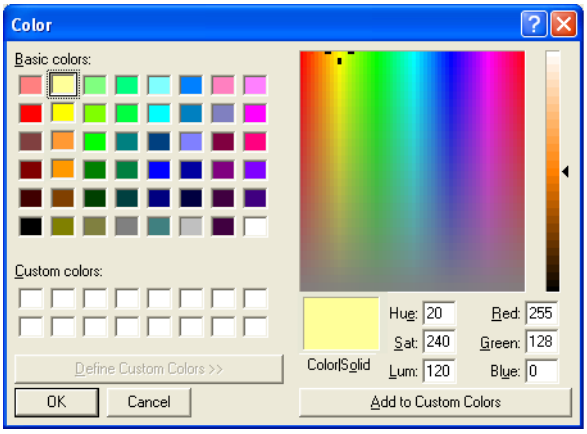
By means of this dialogue the different discriminator day type may be added, deleted or modified. On adding or modifying the following dialogue will appear:

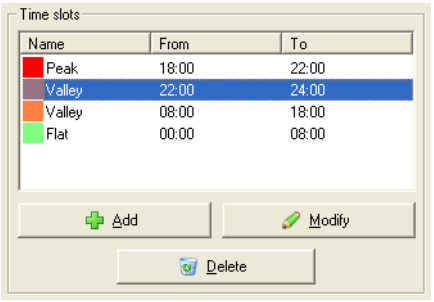


As you can see the definition of a type of day implies indicating the types of hour into which it is divided (e.g. a Sunday could have all day defined as a type of reduced tariff time and a weekday may be divided into two sections i.e. daytime and night-time)

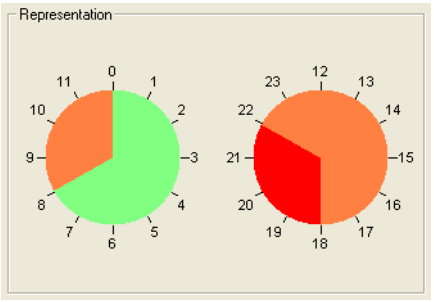
Alphanumeric type data which uniquely identifies the type of day within the discriminator.

Colour that visually identifies the type of day within the tariff. Click once with the left mouse button on the coloured box ; 1, the following dialogue appears, where we can configure the colour for the type of day.



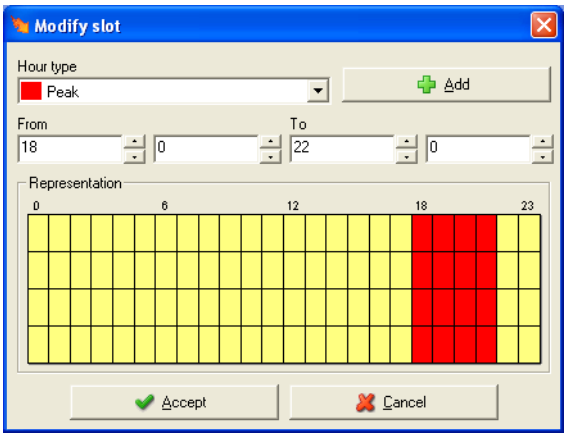


Time zones that configure the type of day. These zones should occupy the entire 24 hour period, but not overlap. In practice different sections within one day indicate that energy is billed differently in each one depending on the time of day in question.



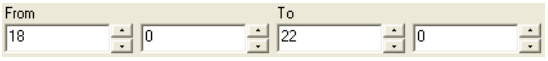
Graphs of time zones. This gives us visual guidance on how we are defining such a day (enabling us to see at a glimpse, among other things, if any time zone throughout the day needs to be confirmed)

By adding or modifying a zone the following dialogue will appear:

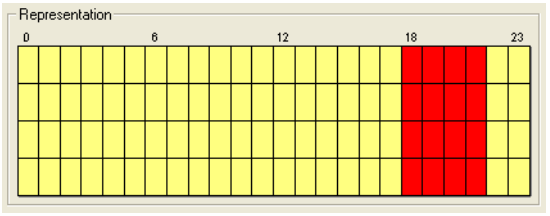


This corresponds to the type of hour within the slot. These types of hours will be those configured in section 5.1.1. Types of hours

Using this button, new types of hours will be added to the discriminator.



Numerical selection of a time zone.



Graph of the time zone. Each column represents one hour of the day, each row is a period of 15 minutes. For the slot selection proceed as follows:

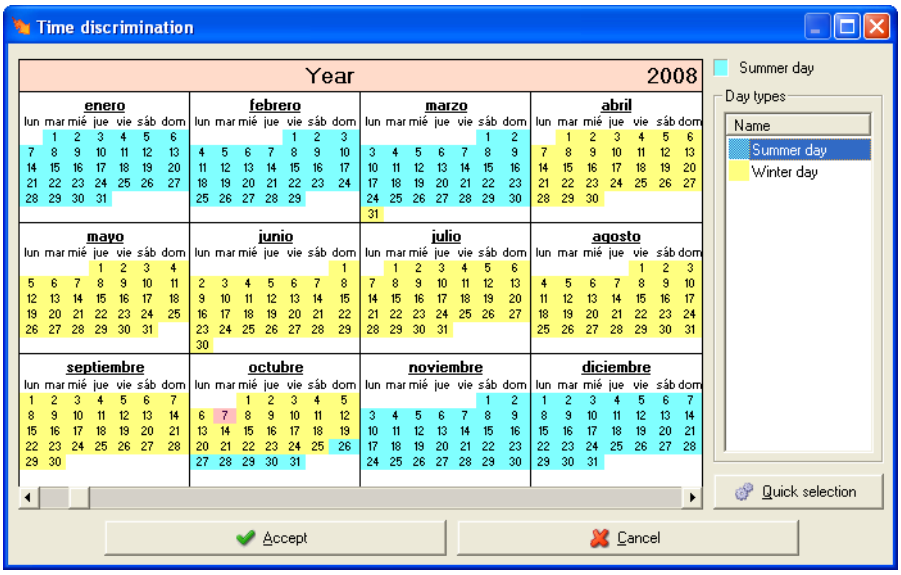
- Click with the left mouse button on the ; start of the time zone.
- Without releasing the button, drag it ; until the end of the time zone.
- Release the button and the time zone will have the colour for the time of day

The zone can be defined manually in a numerical way but this is only useful if one wants to accurately define any slot precisely in minutes (for instance a zone from 10.10 to 15.40).

This dialogue only allows a continuous time zone to be defined.

5.1.3 Calendar

Once the types of days that will make up the discriminator are defined they will then be distributed in a complete calendar. To this end the types of days created beforehand in the discriminator process will be distributed on these calendars.



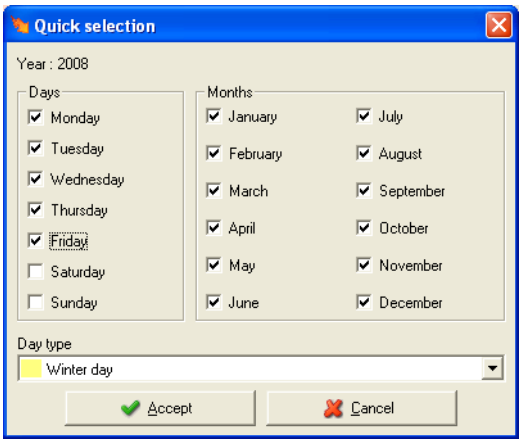
We can assign types of days not only to the days of the year in course, but also to previous and forthcoming years. Selecting the days can be carried out in the following ways:

- Click twice with the left mouse button on one day, highlighting only the selected day.
- Click once with the left mouse button on a start day, and then holding down the Shift key, click once with the left mouse button on the final day, thus selecting every day between the start day and the end day.
- Using the quick selection option.

Listing with the different types of day configured in the tariff.

Summer day Type of day that will be assigned to the calendar if selections are made on it, if there is no kind of day selected, Deleting... will appear, indicating that the days on the calendar, will be selected rather than deleted.

Quick selection With this option selections will be made automatically. The following dialogue will appear.

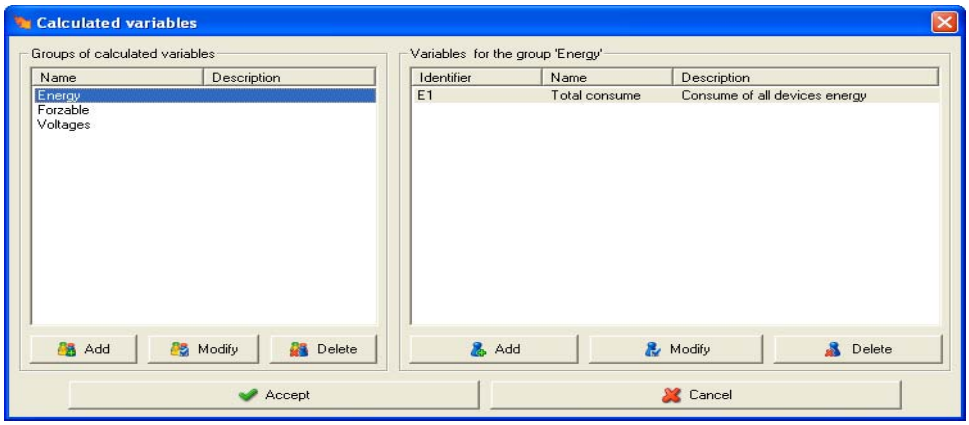


In this case every working day of 2005 will be checked with the type of day "Winter Day" .

6 Calculated variables

There are certain situations where it is necessary to obtain the results of an operation between the variables of the different devices, for example the sum of energies. PowerStudio has this type of feature available for the so-called calculated variables. The values of these variables will be the result of formulas comprising variable values from other devices or other calculated variables.

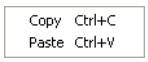
For a better organization, the calculated variables will be divided into groups of calculated variables.



Through this dialogue the groups will be defined and the variables calculated that can be used in the software.

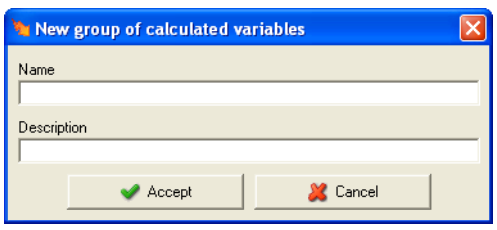
The list situated on the left contains the different groups of variables calculated, while the list on the right will show the variables calculated from the selected group.

By clicking the right mouse button on the list of groups the context menu will appear.



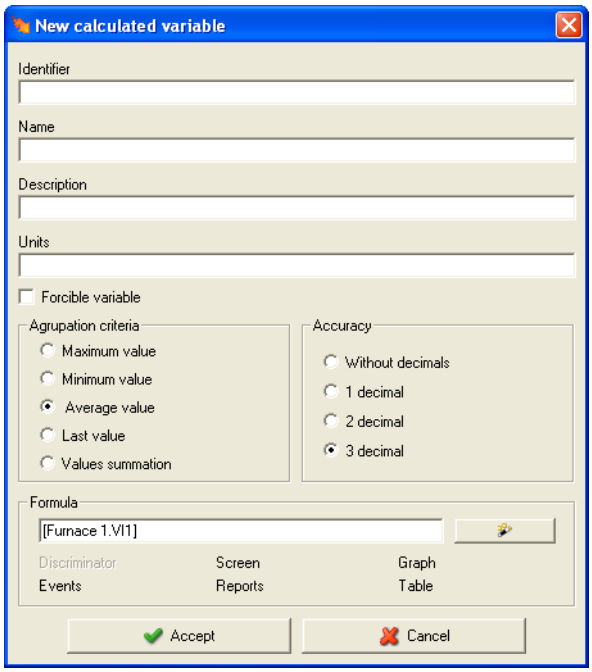
Allowing calculated groups of variables to be copied or pasted. It is possible that some of the options in the context menu do not appear, copy will only appear on the list if a group has been selected and the paste option only if groups have been previously copied to the clipboard. If there is no group selected and there are no groups of variables calculated on the clipboard when clicking the right mouse button the context menu will not be visible.

By adding or modifying a group the following dialogue will appear:



Where the name of the group of calculated variables and a brief description should be entered for better identification within the software.

If you want to add or change a calculated variable, this dialogue will appear:



That will permit the configuration of the calculated variable.

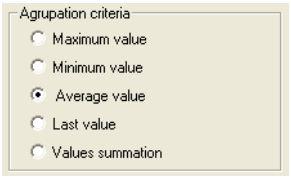
Allows each of the calculated variables to be used in expressions and conditions, see section 14.2 Expressions and conditions.

Name of the calculated variable, used to better identify the variables.

Allows a textual description of the calculated variable to be entered.

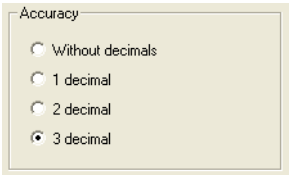
Text of the units in which the calculated variable value is expressed.

Allows the possibility of changing the value of the variable from the SCADA screen or an event to be enabled ☑,or ☐ disabled. Only variables that do not contain references to other variables, devices or calculations in the formula may be forced.



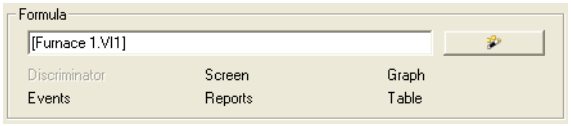
Enables the grouping criteria for the virtual values in graphs, tables and reports to be selected. For example, if we have a value each 5 minutes (e.g. 10, 12 and 7) and we group together the values every 15 minutes, this is group together the 3 values in 1, the value obtained will be:

- Maximum value. The maximum value of the 3 (12) will be shown
- Minimum value: The minimum value of the 3 (7) will be shown.
- Average value: The average value of the 3 ((10 + 12 + 7) / 3 = 9.66) will be shown.
- Last value: The last value (7) will be changed
- Sum of the values: The sum of the values will be shown (10 + 12 + 7 = 29).



This enables the number of decimal places for the calculated variable to be selected.

Here the formula which will give the result of the virtual variable is shown. It can be entered manually or using the "*wizard*" button (see appendix 14.2.1 Wizard for the creation of expressions and conditions). On entering the formula it will be automatically analysed and where it can be used will be shown. For example:



It can be used on SCADA screen and reports, to make graphs and tables with the values obtained, it can be used in the event conditions, but a discriminator cannot be applied.

The calculated variables are codified for their use in formulas and expressions like

R$CAL_group.variable

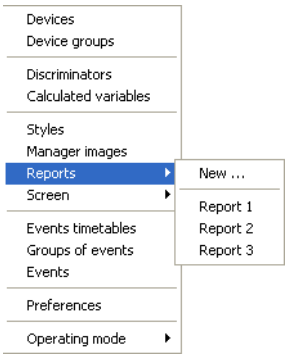
Using the prefix *R$CAL* the program will know that this is a calculated variable rather than the *variable* of a device, *group* will correspond to the name of the group to which the calculated *variable* belongs and finally, *variable* to the identifier entered in the field corresponding to the calculated variable.

7 Reports

The "*Reports*" option from the '*set up* ' menu enables templates for reports to be designed.

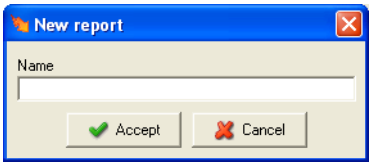
7.1 Add, modify and delete reports.

To create, modify or delete reports the "*Reports*" option from the '*Configure* ' menu should be clicked. Then several options will appear depending if the reports have been previously created.



As can be observed in the figure, the option '*New* ' will appear which will enable a new report to be created followed by the name of the reports that have been created until the present (if there are any). Clicking the right-hand mouse button on any of the already existing reports will offer the possibility of modifying names and eliminating reports.

In the case of selecting the '*New*' option a window will appear where the name of the new report to be created can be chosen.

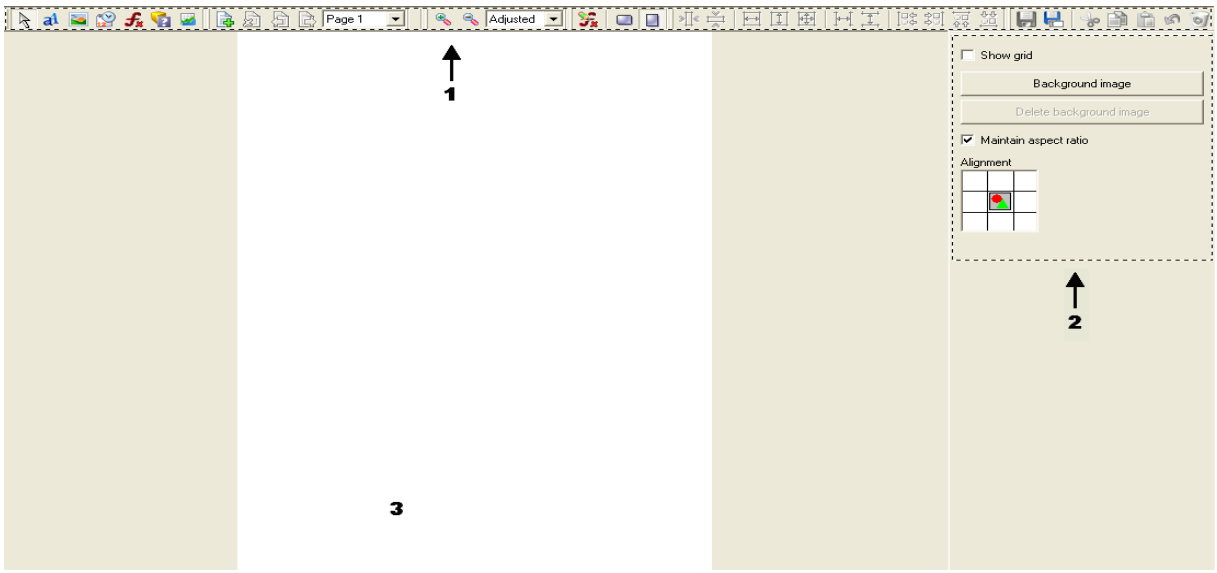


If we select '*New*' or directly some of the already existing reports, a report design window will open.

7.2 Report design window

For editing reports the editing working mode must be used (see section 2.2.12 Operating mode).

The report design window looks like this:



The window is divided into three areas:

- Tools (1)
- Information panel (2)
- Report sheet (3)

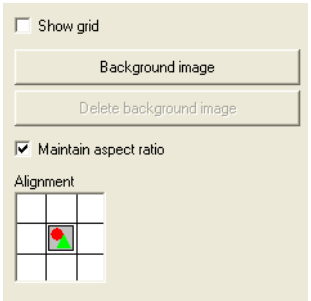
The tools allow the report design to be configured more easily.

The information panel enables us to access all the configuration options of a control which is added to the report design and is selected at this time.

The report sheet is the report design view.

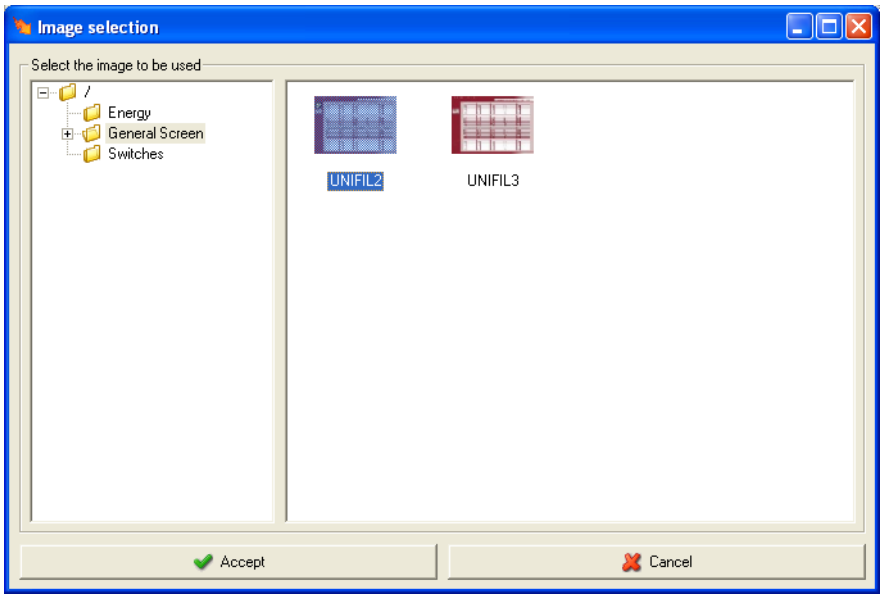
Therefore, through the tools (1) controls can be entered in the report sheet (3) whose properties can be configured in the information panel (2).

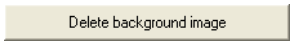
When a new report is being created, the background configuration properties of the report in the information panel will automatically appear. These properties are the same as those which appear if at any time there is no control selected.



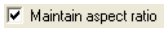
The "*Show grid*" option enables the grid which indicates the position of objects on the screen to be shown or hidden. If the grid is shown, the object will be automatically aligned to the points of the grid.

By selecting this option one of the images added to the image manager can be selected (see section 2.2.6 Image manager) so that it can appear in the report background.

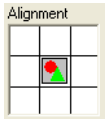




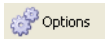
Click on this button to delete the present background image.



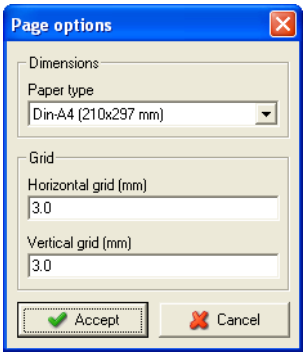
When enabled, this option will maintain the width and height proportions of the selected background image. If disabled, it will force the image to occupy the entire length and width of the report sheet, expanding or contracting it as required.



It enables the image chosen to be situated as the background in any of the seven positions defined in the figure.

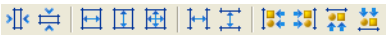
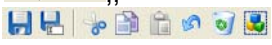


This button (situated in the upper toolbar) allows the characteristics of the grid to be configured as well as the size of the report sheet we are detailing:



The size of the report sheet is selected from a list of standards for types of paper (DIN-A4, A3, A2, etc.) and the size of the grid will specify in millimetres, the distance between one point of the grid and another either horizontally or vertically.

In terms of tools, there are several grouped together depending on their use:

- Action Tools
- Position Tools 
- Page Tools
- Zoom Tools ;
- Various Tools ;;
- Edition Tools  ;;

7.2.1 Action tools

7.2.1.1 Select controls

This tool allows the user to select one or more controls that have been placed already on the report sheet to edit their properties or to apply any other tool. To select a control just click the left mouse button over it. To select more than one control hold down the left mouse button and draw a rectangle covering the controls we want to use. The controls outside of the rectangle remain unchecked or cease to be selected if previously checked.

The behaviour of this tool can be amended if we hold down the "*Control*" key or the "*Shift*" key. If when selecting the *Control*s we select the "*Control*" key what happens is that the selection we are making will be reversed, i.e. we select the *Control*s that are not selected and we will no longer select those which are. If we hold down the "Shift" key what we will do is add controls that have not been selected to those which already have been.

7.2.1.2 Text control

This tool will allow the inclusion in the report of fixed text chains. Once this tool has been selected, it will be necessary to draw a rectangle on the report by keeping the left mouse button pressed. The properties than can be configured from this control are:

We may choose a text style created beforehand or create a new personalised one.

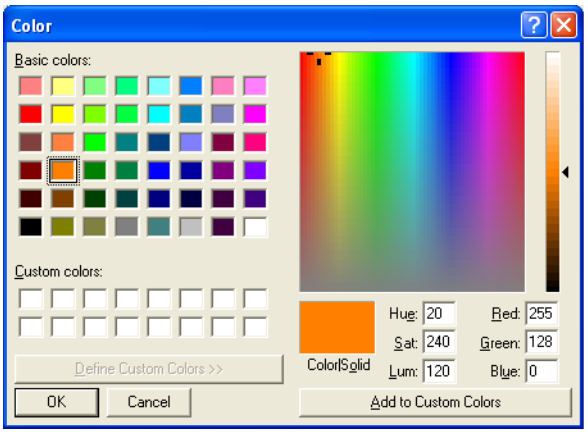
Will correspond to the font type used for the text.

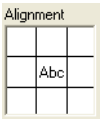
Depending on the font selected, you can choose bold and / or italics.

Corresponds to the size of the font. The size could be between 1 and 90. The size can be either keyed in or selected from the dropdown menu which shows the options available.

Corresponds to the text direction. The orientation (expressed in degrees) could be between 0 and 350. The size can be either keyed in or selected from the dropdown menu which shows the options available.

Clicking on this allows the text colour to be selected.





This will permit us to decide on which part of the rectangle defined in the report sheet the text will be situated.

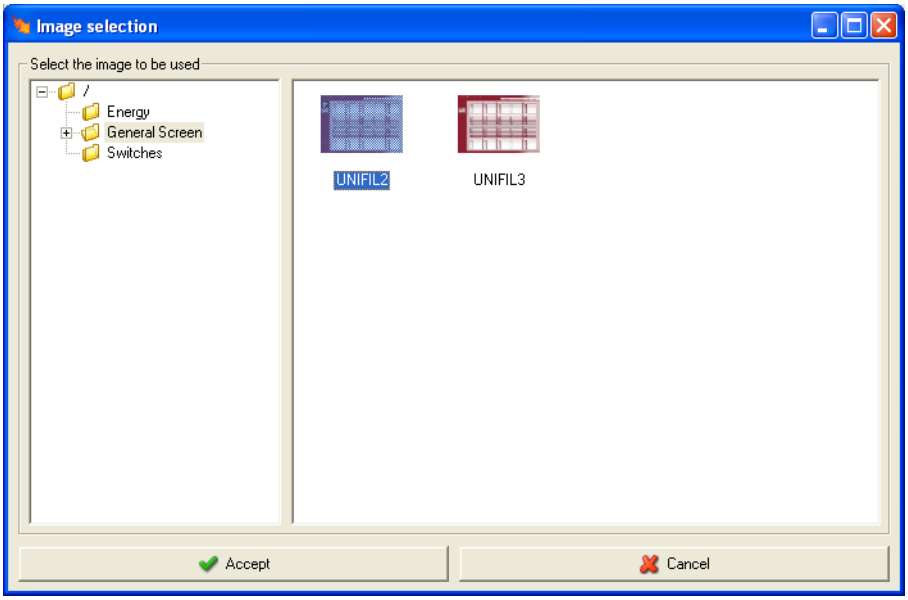
The text to be displayed is written here.

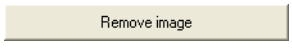
This button will allow us to add as a style the personalised configuration that we have identified for the control of the active text, and thus be able to use the style in other controls.

7.2.1.3 Image control

This tool will allow us to include still pictures into the report. Once this tool has been selected, it will be necessary to draw a rectangle on the report by keeping the left mouse button pressed. The properties than can be configured from this control are:

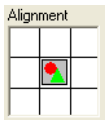
By selecting this option an image from the image manager can be selected, see section 2.2.6 Image manager, to select an image to assign to the control shown in the report.





Click on this button to delete the present background image.

If enabled, this option will maintain the width and height proportions of the selected image. If disabled, it will force the image to occupy the entire length and width of the rectangle defined in the report, expanding or contracting it measurements as required.



This will help decide on which side of the rectangle defined on the report sheet the image will be placed.

7.2.1.4 Date Control

This tool allows a date to be entered in the report (real or not). Once this tool has been selected, it will be necessary to draw a rectangle on the report by keeping the left mouse button pressed. The properties that can be configured from this control are:

This option enables the type of date shown on the report to be chosen. The following choices are available:

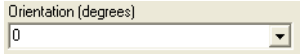
- *Any date:* Any date defined by the user.
- *Present date:* The date at the moment the report is made.
- *Start date:* The starting date for the information used in the report.
- *Final date:* The end date for the information used in the report.

We can also select the style of text created previously or create a new personalised one for the date.

This corresponds to the type of font used for the text of the date.

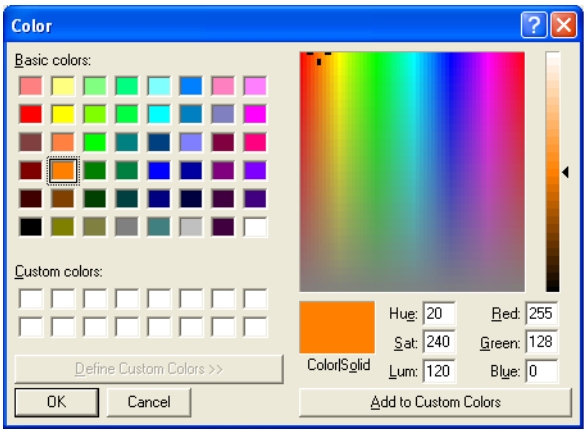
Depending on the font selected, you can choose bold and / or italics.

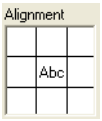
Corresponds to the size of the font of the date text. The size could be between 1 and 90. The size can be either keyed in or selected from the dropdown menu which shows the options available.



Corresponds to the orientation of date text. The orientation (expressed in degrees) could be between 0 and 350. The size can be either keyed in or selected from the dropdown menu which shows the options available.

Clicking on the button the date text colour can be selected.





This will allow us to decide on which part of the rectangle defined in the report sheet the date text will be placed.

Here the date format will be established. Several are pre-defined and can be manually entered from the keyboard. The different models defined are:

- y → year. If the number of letters is 3 or more the full year is represented (2006) and if not the abbreviated value (06).
- M →Month. If the number of letters is 3 or more it will be interpreted as the name of the month, if not the number of the month.
- d → date. The number of letters will be the minimum number of digits with which the value can be represented.
- E →Day of the week. If the number of letters is 4 or more the full name of the day of the week is represented. If the value is less the abbreviation of the name is represented.
- H → Time of day from 0 to 23. The number of letters will be the minimum number of digits with which the value can be represented.
- m → minutes. The number of letters will be the minimum number of digits with which the value can be represented.
- s → seconds. The number of letters will be the minimum number of digits with which the value can be represented.
- ‘ → Using speech marks a text can be added to any part of the model. The apostrophe is only needed if some of the characters used in the model are required.

This option will only appear in the case of having selected ‘any date‘. Therefore a specific date can be chosen to show in the report.

This button will enable us to add as style the customised configuration that we have defined to control the active text and to use this style in other controls.

7.2.1.5 Formula control

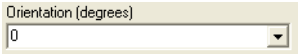
This tool will permit a formula to be included in the report (the final result will be seen in the report). Once this tool has been selected, it will be necessary to draw a rectangle on the report by keeping the left mouse button pressed. The properties than can be configured from this control are:

We can also select the style of text created previously or create a new one personalised for the formula.

This will correspond to the font type used for the text of the formula.

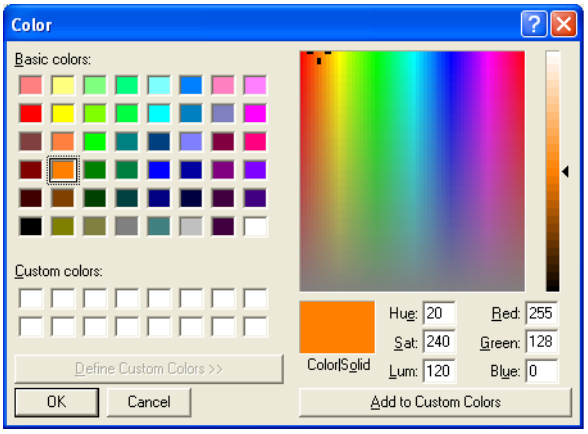
Depending on the font selected either bold and/or cursive can be selected.

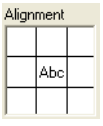
Corresponds to the size of the text font of the formula. The size could be between 1 and 90. The size can be either keyed in or selected from the dropdown menu which shows the options available.



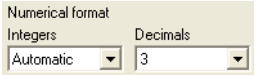
Corresponds to the orientation of text formula. The orientation (expressed in degrees) could be between 0 and 350. The size can be either keyed in or selected from the dropdown menu which shows the options available.

Clicking on the button the colour formula of the text can be selected.





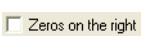
This will permit us to decide on which part of the rectangle defined in the report sheet the text formula will be situated.



Using these selectors the number of whole and decimal numbers shown by the result value of the formula calculation can be specified.

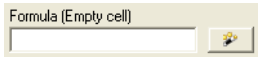
This option will only be available if a specific number of whole numbers has been specified in the previous option.

If the value resulting from the formula does not reach the specified whole number, the remaining spaces will be filled with zeros



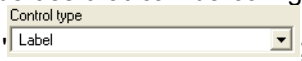
This option will be available only in the event that a specific number of decimal places has been selected in the previous option. Then, in the event that the values resulting from the formula were not reached, the remaining number of decimal places with be filled with zeros.

Will display a thousands separator in the value resulting from the formula. This separator will depend on the regional configuration of the system where the programme is running.



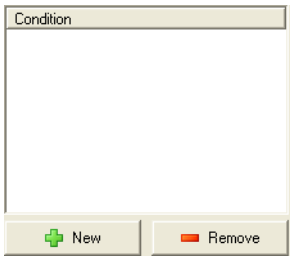
Here the formula that will give place to the result to be shown on the report sheet will be specified. It can be entered manually or using the "*wizard*" ; (see appendix 14.2.1) Wizard for the creation of expressions and conditions.

7.2.1.6 Conditioned control

This tool will allow us to include both a control and the previously defined data (text label, image, formula ,date) in the report, that will be shown only when compliant with a specific condition. The properties that can be configured for this tool will depend on the type of control which has been chosen 

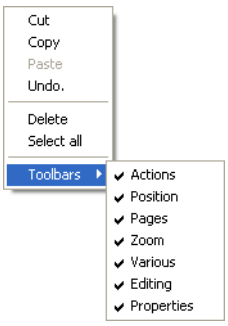
;. The common options are:

Here the condition is specified which gives rise to the appearance on the report page of the chosen control. It can be entered manually or using the "*wizard*" (see appendix 14.2.1) Wizard for the creation of expressions and conditions).



Once the condition has been specified, click the 'New' button and the condition will be added to the condition list. To delete a condition from the list just select it or push the 'Delete' button. When there is more than one condition on the list, the control will activate when one of more of them is complied with.

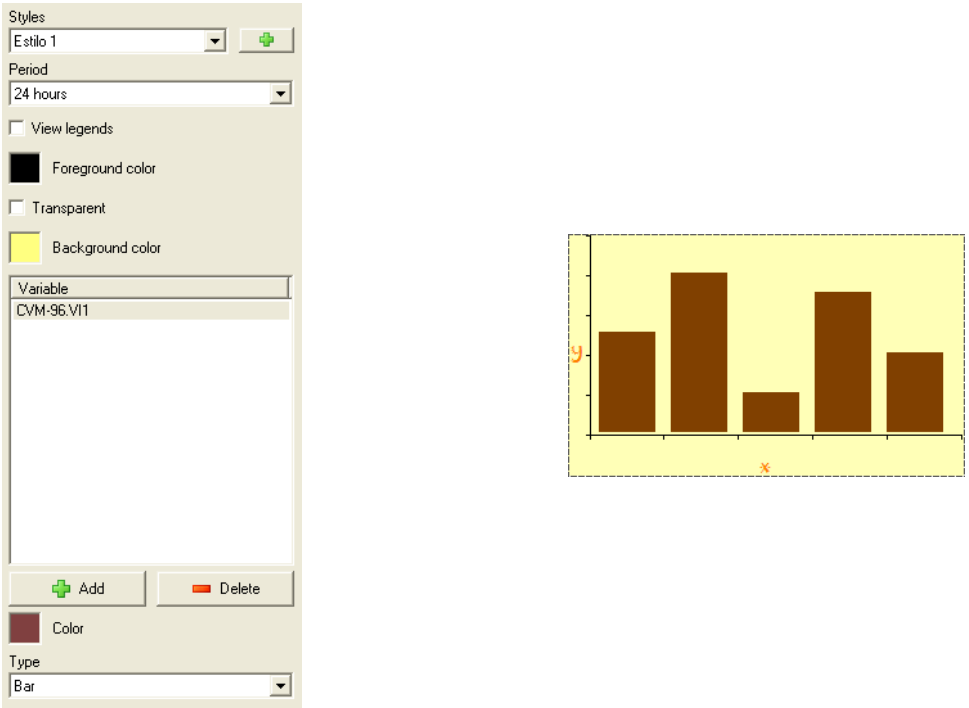
Clicking the right-hand button of the mouse on the report sheet will enable us to cut, copy, paste, delete, select all the controls or show or hide the toolbar.



7.2.1.7 Embedded Graphic Control

This tool allows us to include a graph embedded in a report. This control, like others, can be placed anywhere in the report and enables a large amount of variables to be viewed.

This control allows the style of the same to be configured (the style of the texts of the axes and keys, namely the font, size, colour, etc.). If you want to see or hide the variable keys, the colour of the axes, the background colour (it can also be transparent) and the variables to be represented.



Control properties of the graph embedded in reports and the control representation

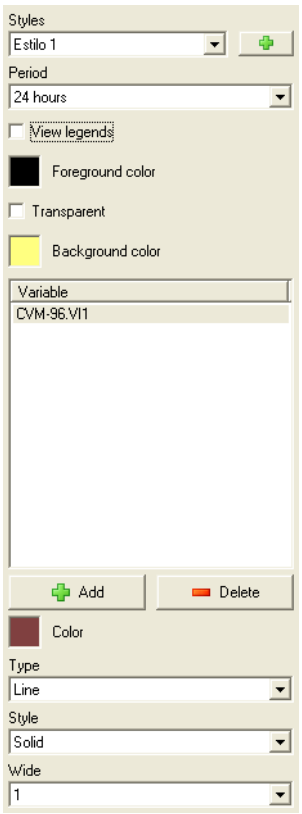
For each variable it is possible to choose the colour and type of representation we want. The types possible are bar graph, lines or points. For scatter type representations we can select between dots, circles (5x5), squares (5x5), diamonds (5x5), X (5x5), Crosses (5x5), Xs (3x3) and Crosses (3x3). Also, for the line representation, the style can be chosen (solid, dashed, dotted, line-dot and line-dot-dot) as well as thickness (between 1 and 10 points).

The most important parameter, apart from the variables to be represented, and that will determine the final aspect of the graph (and, most importantly, the amount and distribution of information to show), is the period of time.

The period can be automatic, 5 minutes, 10 minutes, 15 minutes, 20 minutes, 30 minutes, 1 hour, 1 day and 1 month. In the event that the period is automatic we can choose the number of values of the variables that make up the graph we want to see.

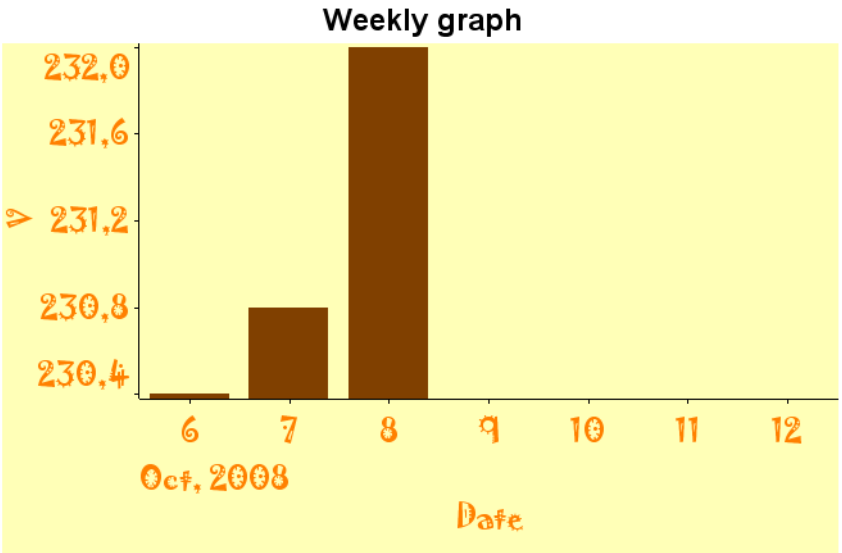
There is a fundamental difference between choosing the automatic period or any other period. If we choose the automatic period, the data will be grouped with the period of the report and, if we have generated a report for one week, we will have variable values to be represented in the embedded graph grouped in weeks, so that for the week we are generating the report we have a unique value. It is therefore necessary to choose those values with the group we want to visualize, that is, for example indicate how many weeks, generally periods, we want to see (these periods are always prior to the period of the report). Thus, if we generate a monthly report with a graph embedded with an automatic period and with 6 values, we will see a chart with values grouped by month, displaying the month of the report (last value) and the previous five months. If we choose a period that is not automatic the values represented will be grouped with the given period and only those included in the period of the report will be included. For example, if we make a weekly report and we have defined the period of the embedded graph as one day, we will see a graph of the week's report with

the values grouped by days (typically 7 values). With a period other than automatic we will never see values that are not included in the period of the report, in contrast with an automatic period we can see values of periods prior to the report.



Embedded Graph properties with an automatic period

Once generated and displayed in the client, the graph might look like this:



7.2.1.8 Common options for the action tools

Any control entered in the report sheet can be re-sized and moved. To re-size a control just place the mouse pointer on one side of the rectangle which surrounds the control and keep it pushed while moving it in the desired direction. To move a control the left-mouse button must be clicked on it

and must remain pressed while moving the mouse in the desired direction. It will also be possible to move more than one control while grouping them inside a rectangle. The left-hand mouse button should also remained pressed at the same time to group two or more controls, drawing a rectangle including the controls we wish to move inside it.

7.2.2 - Position tools

Horizontally centre: At least one control should be selected for use. With this control one or more controls situated on the report sheet can be aligned horizontally. The control or controls will move to the left or the right to end up completely aligned on the page. If this option is used with the "*Control*" button pressed each of the controls selected will be aligned independently.

Vertically centre: At least one control should be selected for use. With this control one or more controls situated on the report sheet can be aligned vertically. The control or controls will move up or down to end up completely aligned on the page. If this option is used with the "*Control*" button pressed each of the controls selected will be aligned independently.

Horizontally re-size: At least two controls should be selected so this tool can be used. The horizontal size of a control can be aligned to another existing one using this tool. To carry out this adjustment the 'Control' key should be pushed and with the left-hand mouse button the different controls will be selected to be re-sized. The last control selected will be that which is taken as a reference to carry out the re-sizing of the others, i.e., all the selected controls will end up with the horizontal size the same as the last control selected.

Vertically re-size: This tool carries out the same function as the horizontal re-sizing but with reference to the vertical size of the last control selected.

Re-size vertically and horizontally. This tool will simultaneously re-size horizontally and vertically.

Redistribute space horizontally: At least three controls should have been selected so this tool can be used. The horizontal position of the selected control can be adjusted so that the same distance exists between them. I.e., that the controls to which this tool has been applied will each have the same distance at the sides (left and right).

Re-distribute space vertically: This tool carries out the same function as the horizontal space redistribution but with reference to the vertical re-distribution.

Align to the left: At least two controls should have been selected so this tool can be used. The control enables the position to be aligned to the level of the part furthest to the left of the other. To carry out this adjustment the 'Control' key should be pushed and with the left-hand mouse button the different controls to be aligned will be selected. The last control selected will be that which is taken as a reference to carry out the alignment of the others, i.e., all the selected controls will be aligned to the left at the level of the last control selected.

Align to the right: This tool carries out the same function as aligning to the left but to the right of the last selected control.

Align top: At least two controls should have been selected so this tool can be used. The control enables the position to be aligned at the level of the upper section of another. To carry out this adjustment the 'Control' key should be pushed and with the left-hand mouse button the different controls to be aligned will be selected. The last control selected will be that which is taken as a reference to carry out the alignment of the others, i.e., all the selected controls will be aligned at the top at the level of the last control selected.

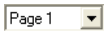
Align bottom: This tool carries out the same function as aligning at the top, but at the bottom of the last control selected.

7.2.3 - Pages tools

Add page: This tool will make it possible to add a new page to the report. The reports can have multiple pages with different contents. Each of these pages is linked to a single report and the only common element between different pages of a report is formulae.

Remove page: This tool will remove the page that is active when you click the button.

Forward / Back: These tools will allow us to move around the different pages on which the report is composed (if any).



Using this control will directly show a page of the report without having to progress page by page with the tools described above. Clicking the control will open up a list of pages available for the report which is active at the moment.

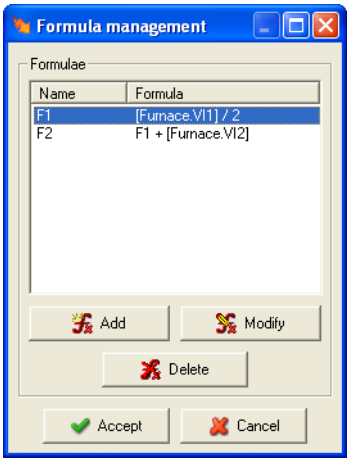
7.2.4 - Zoom tools

Zoom in/Zoom out: Using these tools you can zoom in or out from the image that is currently defined for the display of the report sheet.

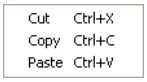
This control will serve to indicate a specific zoom to implement on the report sheet. The values range from 50% to 1000%. You can also configure on the 'Adjusted' mode, which would adapt the zoom to the report sheet being displayed, to appear as large as possible given the screen resolution where the program is running.

7.2.5 – Miscellaneous tools

Configure formulas: Using this tool, formulas can be defined which may be applied or reference can be made to them or any of the report pages for which they have been defined. The following window will appear when the button is clicked:

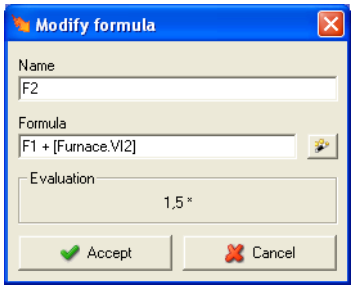


Clicking the right-button of the mouse over the list of formulas the following contextual message will appear.



enabling cutting, copying, or pasting variables, both in the same report as well as enabling the copy of formulae to be copied between different reports or SCADA screens. It may be possible that some of the options from the context menu do not appear, cut and copy will only appear if there is a formula selected and the paste option only if the formulae have been copied or cut onto the clipboard. If no formulae are selected and there are no formulae on the clipboard when the right button is clicked the context menu will not appear.

Clicking the '*Delete*' button the formula selected will be deleted. Push '*Add*' or '*Modify'* to open the formula modification window:



Where we can give names to the formula and itemize it (see appendix 14.2 Expressions and conditions). It should be noted that there are certain formula names not permitted, therefore the name of the formula cannot contain certain types of special characters nor be one of the reserved words. The reserved words are those that match the name of a function available (see appendix 14.2 Expressions and conditions).

Horizontal/Vertical Orientation: This tool enables the orientation of the report sheet to be defined. Controls do not reorganise on changing from horizontal to vertical or vice versa so it is possible that they may no longer be seen when carrying out this kind of change. However, these controls will continue to exist and if the change is carried out again they will become visible again.

7.2.6 - Editing tools.

These tools carry out the same operations as the options from the menus *'File'* and *'Edit'*, see sections 2.1 File Menu and 2.3 Edit Menu.

Save. This tool allows changes made in the report to be saved.

Save as: This tool allows a copy of the report to be saved with a different name.

Cut: This tool will copy the controls selected to the clipboard and delete them from the report. The same result will be obtained clicking the combination of "Control" + "X"

Copy: This tool will copy the selected controls to the clip board. The same result will be obtained clicking the combination of "Control" + "C"

Paste: This tool will paste the clipboard controls in the report. The same result will be obtained clicking the combination of "Control" + "X"

Undo: This tool allows recent changes to be reversed to edit a previous state. The same result will be obtained clicking the combination of "Control" + "Z"

Delete: This tool will delete the controls in the report.

Select everything: This tool will select all the report controls. The same result will be obtained clicking the combination of "Control" + "E"

8 Scada

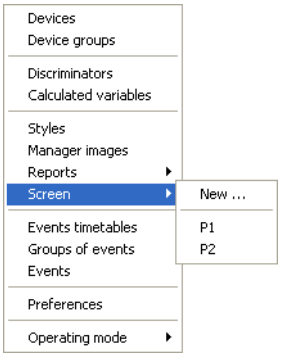
The SCADA allows us to display one or more windows, with or without a background image, incorporating display control, turning the PC into a powerful and versatile synoptic panel of the installation.

The aim is to generate an application, consisting of one or more screens, which can run autonomously in the appointed facility.

A standard application would consist of a main screen which will serve as a basis for others that will appear according to the given requirements. The number of screens is only limited by the existing PC conditions where the program is running.

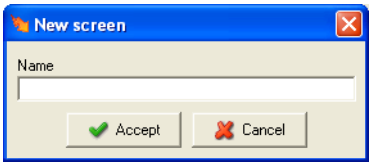
8.1 Add / Remove screen

To create, modify or delete screens in the SCADA Click the ‘screen’ option in the 'Setup' menu. Several options will appear depending if SCADA screens have been previously created.



As can be observed in the figure, the option ‘New’ will appear which will enable a new screen to be created followed by the name of the screens that have been created until the present (if there are any). Clicking the right mouse button on any of the screens already in place this will lead to options for modifying names and removing the screens.

In the case of selecting the ‘New’ option a window will appear where the name of the new report to be created can be chosen. This name will identify in a unique way the screen in the SCADA system.



If we select ‘new’ or directly some of the already existing screens, a SCADA screen design window will open.

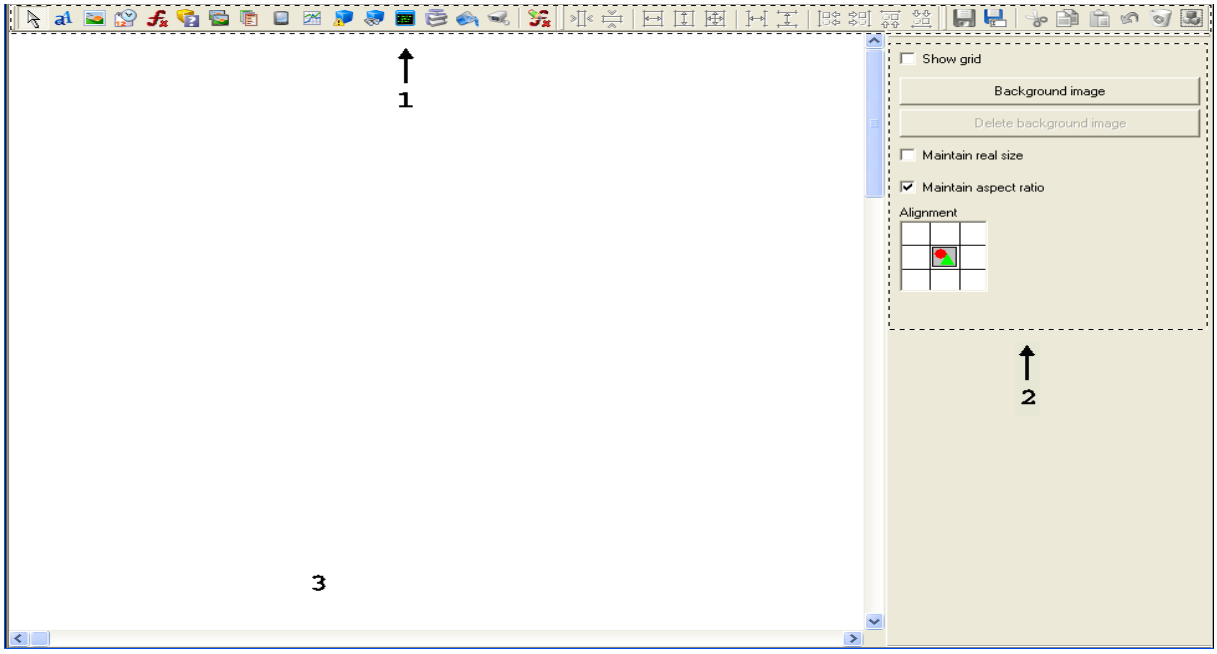
8.2 Editing SCADA screens

For editing screens we must be in the edit operating mode

By editing screens it will be possible to add, change or delete screen controls. These controls may show the value of a variable, perform an action, paint an area of the screen, and so on.

The objective of the screen is to easily display the status of the facility, allowing the situation of the different lines of the plant to be seen, show electrical variables of the installation, etc. The elements that allow this to be achieved will be the screen controls.

The edit window of the SCADA screen looks like this:



The window is divided into three areas:

- Tools (1)
- Information panel (2)
- SCADA screen(3)

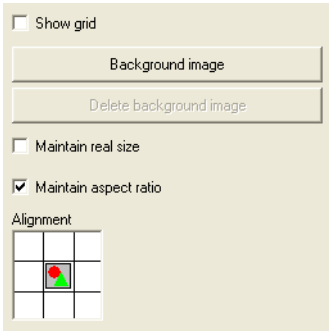
The tools will allow a simpler configuration of the SCADA screen design.

The information panel will allow access to all the configuration options of a control that is being added to the design of the SCADA screen and that is selected at that time.

The SCADA screen is the design view from where the controls are implemented.

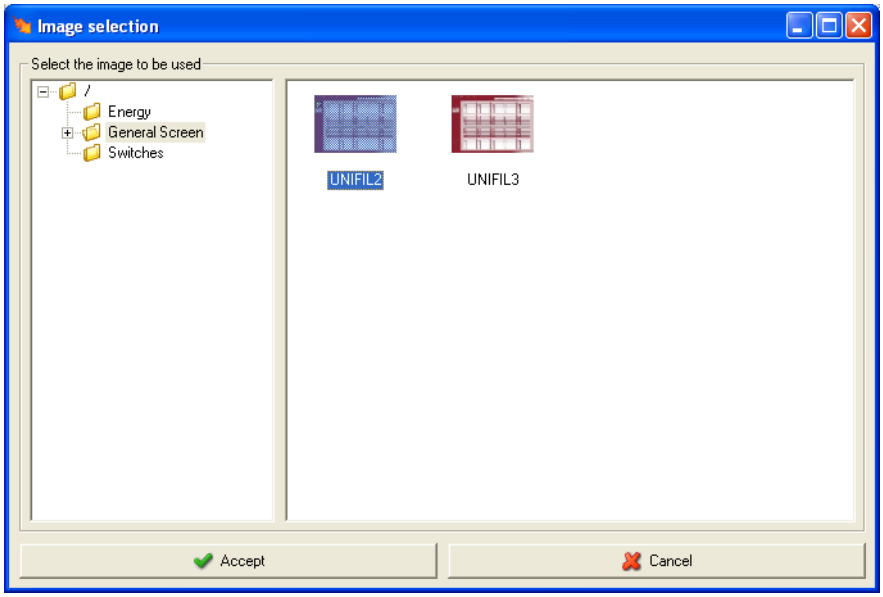
Thus, using the tools (1) controls may be entered on the SCADA screen (3) whose properties may be configured in the information panel (2).

When creating a new SCADA screen, the properties of the configuration of the background of the SCADA screen on the information panel will appear by default. These properties are the same as those which appear if at any time there no control is selected.



Show grid The “Show *grid* “option enables the grid which indicates the position of objects on the screen to be shown or hidden. If the grid is shown, the object will automatically align at the points of the grid.

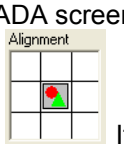
Background image By selecting this option one of the images added to the image manager may be selected (see section 2.2.6 Image Manager) in order to appear on the SCADA screen
as a background.



Delete background image Click on this button to delete the present background image.

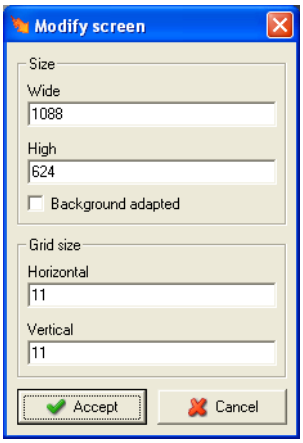
Maintain real size If this option is enabled, the image configured as the background image is displayed in its actual size. If disabled this will be adapted to the margins of the SCADA screen.

Maintain aspect ratio If enabled, this option will maintain the width and height proportions of the selected background image. If disabled it will force the image to occupy the entire width and height of the SCADA screen expanding or shrinking its measures as appropriate.



It enables the image chosen to be situated as the background to any of the seven positions defined in the figure.

Options This button (located on the upper toolbar) will allow the characteristics of the grid to be configured as well as the SCADA screen size being described:



The width and height of the screen is measured in pixels and the size of the grid will specify, in pixels, the distance between a point on the grid and another in horizontal or vertical. If a background image has been selected, the size of the SCADA screen can be adapted to the size of this background by checking box

In terms of tools, there are several grouped together depending on their use:

- Action tools
- Positioning tools ;
- General tools

8.2.1 Action tools

The following action tools actions have already been explained in Chapter 7 Reports.

- *Select controls:* see section 7.2.1.1
- *Text control :* see section 7.2.1.2
- *Control image:* see section 7.2.1.3
- *Date Control :* see section 7.2.1.4
- *Formula control:* see section 7.2.1.5
- *Conditioned control:* Operates in the same way as conditioned control in the reports but also lets the IP camera control be added. see section 7.2.1.6
- *Configure formulae:* see section 7.2.5

In the *date control*, please note that it is not possible to select '*Initial date* and *End date*' as they are meaningless on the SCADA screens.

8.2.1.1 Screen control

This tool will allows us to include access on the SCADA screen on the SCADA screen. The properties than can be configured from this control are:

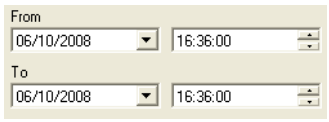
Here the destination screen which will be accessed by clicking on the control entered on the SCADA screen will be specified.

8.2.1.2 Report control

By selecting this option, the control will become direct access to a previously defined report (see Chapter 7). The options available are:

Here the report will be selected to be displayed by clicking on the running mode control.

The type of group for the data to be displayed in the report can be chosen. If the "User Defined" option is selected, the following fields will appear



Where the period is specified from when the report can be viewed.

8.2.1.3 Device Control

By selecting this option, the control will become a direct access to the screens that show the variables of a device. The options available are:

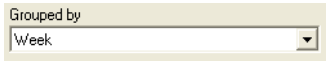
Using this drop-down menu the device will be selected whose variables screen will be displayed on clicking on the control in the running mode.

8.2.1.4 Graph / Table Control

Using this option, the control will be used to make a graph or a table of one or more variables from one or more devices. The options available are:

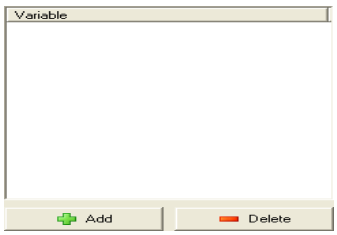
With a choice between graph and table.

Choose the type of graph or table you want to see.



The type of data grouping to be displayed in graphs or tables can also be chosen.

In the same way the period can be specified for the samples for graphs or tables.



Here the variables that are represented by a graph or a table can be added. By clicking the button ‘add’ the variables that you want to add can be selected.

Once selected, the variables will appear on the list and be deleted by the button

8.2.1.5 Active Event Control

Through this option, control will become a short cut to the display window of active events.

8.2.1.6 Event Viewer Control

Through this option, control will become a short cut to the display window of the events stored in files. The options available are:

This will correspond to the group of events on which registers will be filtered.

The type of grouping may also be chosen for the data to be displayed in the events viewer.

The list may be displayed either complete or not.

8.2.1.7 Run Control

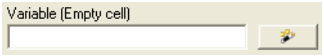
This tool will allow us to include access to another application present in the system in the SCADA screen. The properties than can be configured from this control are:

Here the complete route of the application will be specified which will be called up on clicking on the control entered on the SCADA screen. For example: C:\WINDOWS\SYSTEM32\CALC.EXE.

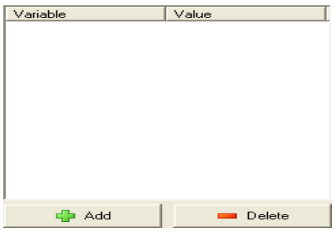
This will specify parameters (if needed) to be added to the application call indicated in 'Program'.

8.2.1.8 Force Variable Control

This tool will allow us to force the value of the variables that can be forced, as in equipment with digital outputs. The properties than can be configured from this control are:



Here the variable at which the value will be forced is specified. It can be entered manually or using the "*wizard*" ; (see appendix 14.2 Wizard for the creation of expressions and conditions).



Once the variable has been specified, Clicking the 'New' button will add this variable to the list of forced variables. To delete a variable from the list just select it or push the '*Delete*' button. All variables on the list when clicking on the control in the run mode will be forced to the status established in each one of them, defined below.

Here we specify what action to take when the control is enabled in the execution mode (open or close). This selector will appear when the values to which it is possible to force the variable, is a list of specific values (for example, for a digital output the options will be open or close). If on the contrary, the variable may be forced to any value (for example a counter) a field will appear where you can manually enter that value. This selector will only be enabled when the following

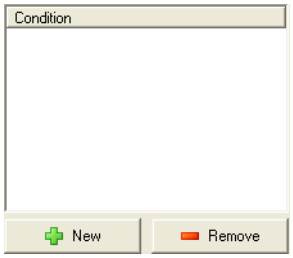
box is checked

; if this box is not checked the value that will appear in the control will be that defined by the user from the screen in the Java Client

8.2.1.9 Filling Control

Filling control allows colour changing in homogeneous zones of the background, or background image, (with all the same colour pixels) regular or irregular. The aspect in the edit mode is marking the point of the pixel from where filling the area will begin. In the running mode it will not be displayed, changing the colour of the area starting with the pixel marked by the point in the edit mode. The properties than can be configured from this control are:

Here the condition that has to be met is specified so that the application paints the area with the chosen colour in the run mode. It can be entered manually or using the "*wizard*" ; (see appendix 14.2 Wizard for the creation of expressions and conditions).



Once the condition has been specified, click the '*New*' button and the condition will be added to the condition list. To delete a condition from the list just select it or push the '*Delete*' button. When there is more than one condition on the list, the control will activate when one of more of them is complied with.

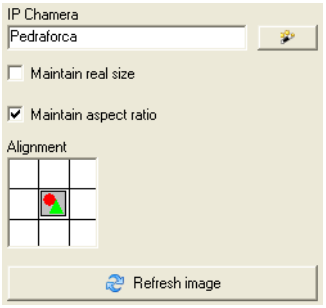
Will allow the floodfill colour to be applied.

If this box is enabled, in the edit mode, a simulation of the final outcome of the floodfill control will be shown, painting the area to be painted as it would be in the run mode if the selected condition is fulfilled.

You can also select the tolerance this control will have, with a maximum of 1000.

8.2.1.10 IP camera control

The IP camera control will allow us to add the image of one of the cameras added to the system in any area of any SCADA screen. This is an image that is refreshed in real time. The properties of this control are as follows:



IP camera control property area

Offers the possibility of indicating from which camera we want to obtain the sequence of images, as well as the properties which will be applied to those images relative to the control size (these properties are equivalent to those available for controlling still pictures).

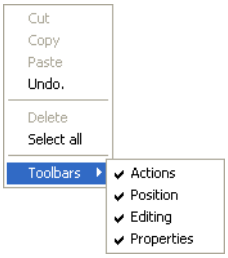
IP control camera representation in the SCADA screens editor

We also have at our disposal the button "refresh image" that will allow us to obtain and display the last available table of the camera, so that we can see if the image arrives properly and that the adjustment properties of the image are properly configured.

IP control camera representation with the image refreshed.

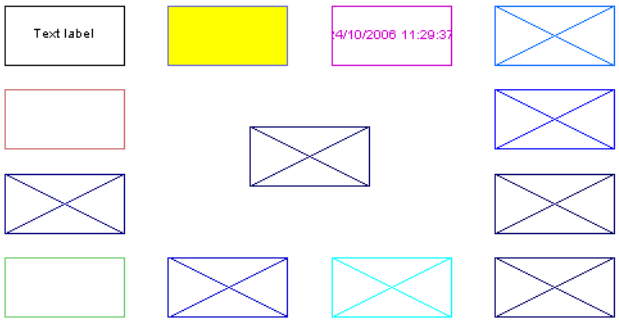
8.2.1.11 Common options for the action tools

By clicking the right mouse button on the SCADA screen it will also be possible to add controls to it. In the same way, the toolbars can be shown or hidden:

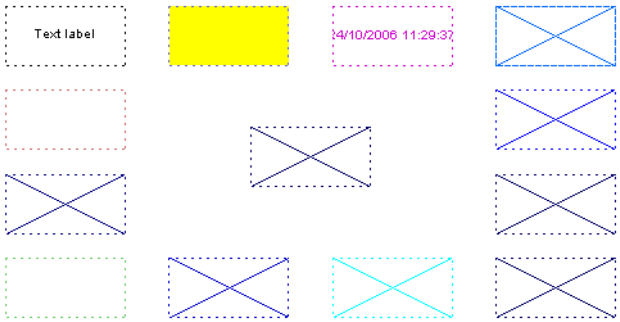


Any control SCADA inserted on the SCADA screen can be resized and moved. To re-size a control just place the mouse pointer on one side of the rectangle which surrounds the control and keep it pressed down while moving it in the desired direction. To move a control the left-mouse button must remain pressed while dragging the mouse in the desired direction. It will also be possible to move more than one control if they are grouped inside a rectangle. The left-hand mouse button should also remained pressed at the same time to group two or more controls, drawing a rectangle with the control we wish to move inside it.

Controls entered into a SCADA screen present the following aspect in normal mode:



When controls are selected a dashed line is shown around them:



8.2.2 Positioning tools

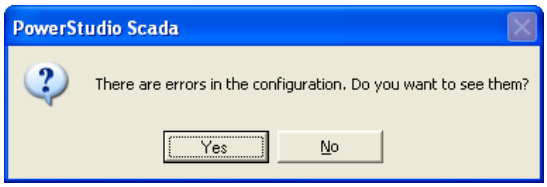
The working of the positioning tools is the same as that which has been explained in Chapter 7.2.2 but applied to SCADA screen controls.

8.2.3 Editing Tools

The working of the general tools is the same as that which has been explained in Chapter 7.2.6 but applied to SCADA screen controls.

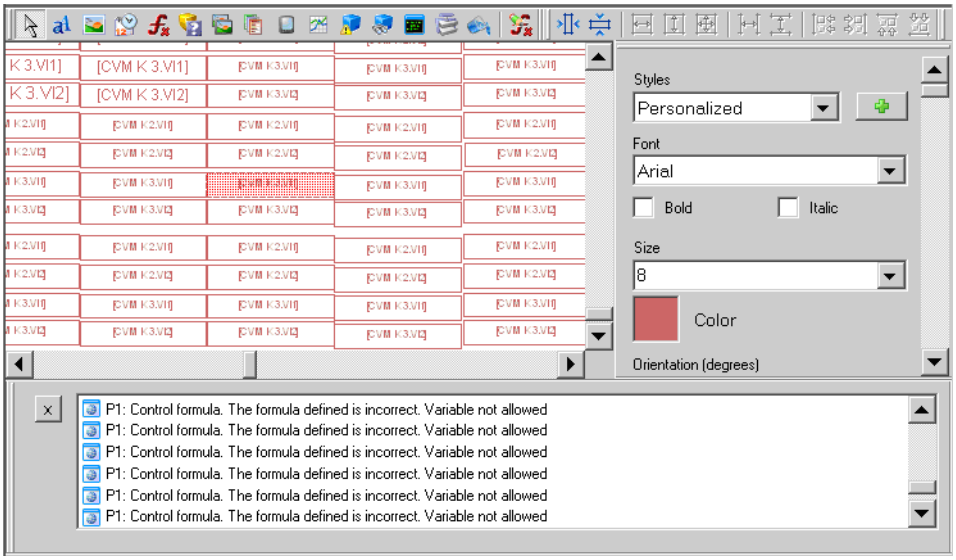
9 Errors detection

On passing to the run mode, PowerStudio will check whether the configuration is correct, checking possible mistakes on SCADA screens, reports, etc. Once the entire checking has been carried out, if there are any mistakes, PowerStudio will give the opportunity of viewing these mistakes and correcting them.



If the answer is "No", and that we do not want to see the errors, we move onto the run mode, but it is possible that the behaviour is not as desired on those controls that contain errors. That is why the configuration should not contain any errors.

An example of a screen with errors would be:



The list below shows the different errors found. The error information consists of the type of resource, name of the resource and a brief explanation of the error found. The different types of resources are

- SCADA Screens
- Reports
- Events

When you double click the left mouse button on an error line, the program will automatically display the SCADA screen, report or event where the mistake was found and if it is a SCADA screen control it will select the control where that error has been detected.

10 Events

The program will only show events when it is in the run mode, the edit mode is when you can add, change or delete the different events that will be useful to warn of potential hazardous or exceptional states in the facility.

The events may be notified. In this case the events will be shown by means of a pop-up screen when enabled, and remain on screen until they have been recognised and disabled.

In addition for each event an invalidation timetable of the event can be defined. That is, the periods in which the event is not valid can be defined and therefore will not be taken into account in the software.

It will also be possible to associate a note each time that the event in enabled, for example to save the value of a variable which has caused the event.

Finally, for each of the possible states of the events, a series of actions can be defined that the software will execute while the event is found in each one of these states. Possible States are:

- *Activation:* Will be produced when the event condition is complied with. For example, a value has exceeded a certain limit.

- *While enabled:* This will be produced while the event condition is complied with, once the event has been enabled.

- *Recognition:* Occurs when the operator carries out an event recognition action. This state is only possible if the incident is reported.

- *Disable or restore:* Occurs when the event condition is no longer fulfilled. For example: if an event is defined such as the variable exceeds a certain value, the disabling will take place when it ceases to exceed that value.

The system event set up consists of event disablement calendars, groups of events and the events themselves. If you have no need to define groups of events or event disablement calendars go directly to section 10.3 Event Configuration.

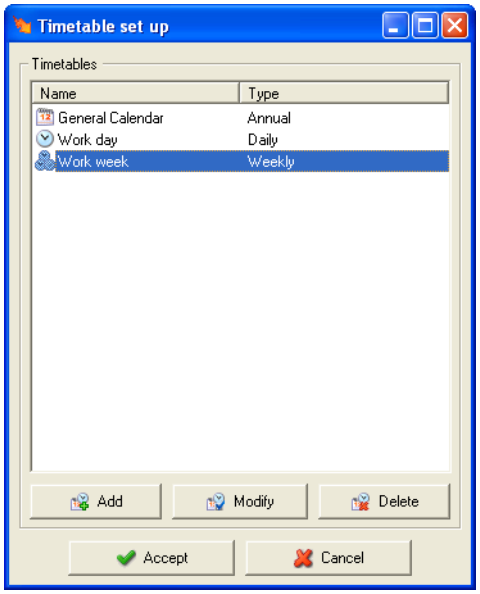
Both timetables and groups can be defined before or after the definition of the events themselves, however if you need to define calendars we recommend this should be done first and so that they can be then assigned to the events when creating them for the first time. In the same way, if you sure which groups of events are to be configured they should be defined before creating the events so that they can be assigned directly on creating each event.

10.1 Events timetables

For each event a disablement timetable can be defined. In this timetable the time zones will be marked where the event will not be taken into account. If you do not want to disable the events you can go directly to 10.3 Event configuration.

The zones in which the event will not be taken into account will be shown in the timetables. Unless otherwise indicated, zones are not configured, the event will be taken into account and the program will monitor the status of the event assessing the condition configured in the event.

To configure the events the option 'Events timetables' from the ' Setup ' menu should be clicked. The following dialogue box will appear:



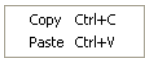
Where the different timetable zones are shown. 3 different types of timetable can be configured

Daily: The disable zones for one day are configured.

Weekly: The disable zones for one week are configured. For the selection of the different days that make up the week the previously configured "*Daily*" types are used.

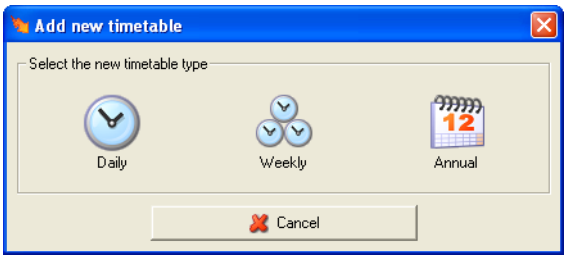
Annual: The disable zones are configured by a calendar. As with the '*Weekly*' type, the days are selected from the previously configured "*Daily*" types.

Clicking the right mouse button on the list of timetables the context menu will appear,



allowing timetables to be copied or pasted. It is possible that some of the options in the context menu do not appear, copy will only appear on the list if a timetable is selected and the paste option only if calendars have been copied previously to the clipboard. If there are no timetables selected on the clipboard on clicking the right mouse button the context menu will not appear.

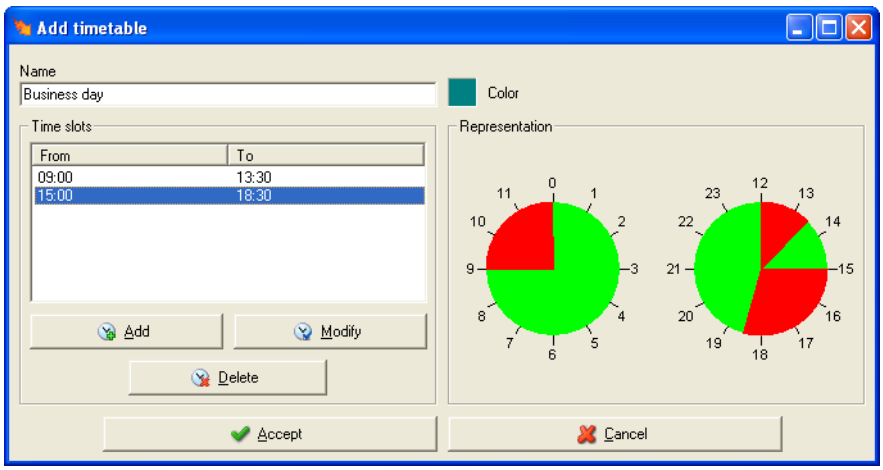
On clicking the "*Add*" button the following dialogue box will appear:



Where the type of timetable you want to add is selected. Once added, the type of timetable can not be changed, that is if one adds a "*Daily*" type, when you click the '*Modify*' button the "*Daily*" type will be modified and in no case can the ' *Weekly* 'or' *Annual*' type be changed.

10.1.1 Daily

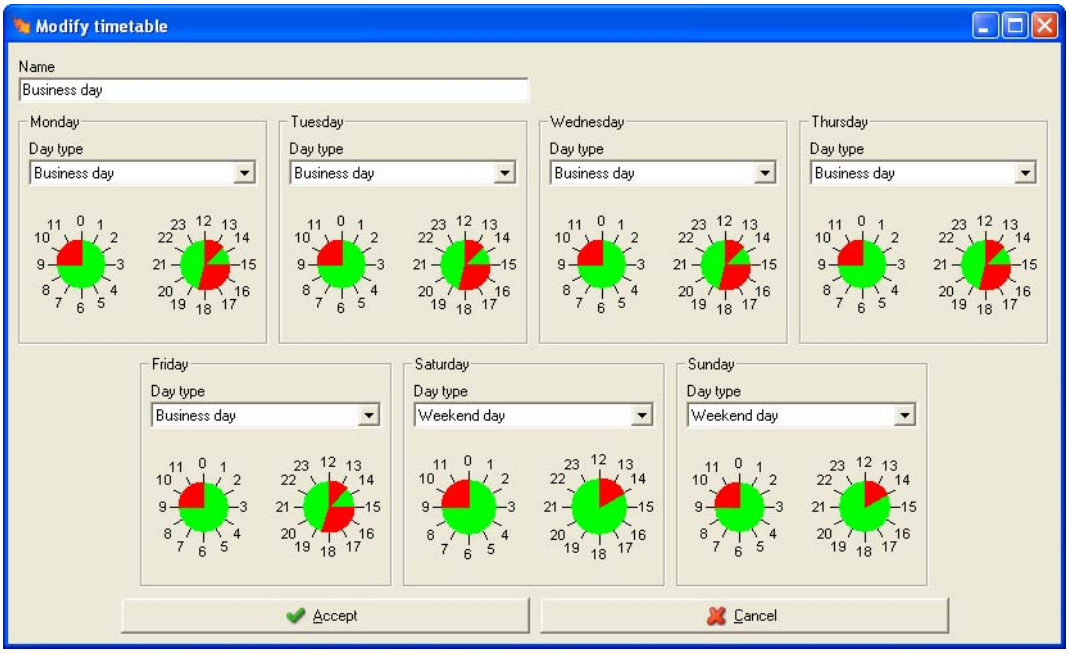
This type of timetable corresponds to a day. In events that have a daily type selected, the disablement slots shall be the same for all days.



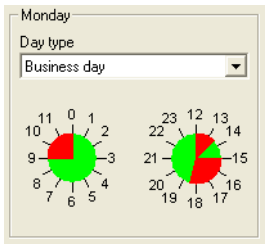
How the configuration of the types of day works is the same as explained for the types of day for discriminators (see section 5.1.2 Types of day), with the difference that there are no different types of hours, but rather the timetable interval is established without taking into account the events (zones marked in red when showing the day).

10.1.2 Weekly

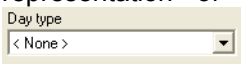
This type of timetable corresponds to one week. In the events selecting this week type, disable zones will be the same for every week of the year.



Alphanumeric type data which enables the weekly type to be uniquely identified within the events timetable.



Configuration of each one of the 7 days of the week, where the 'type of day' selector contains the different types of days configured (see 10.1.1 Daily), showing the representation of the type of day selected. It will also be possible not to select any

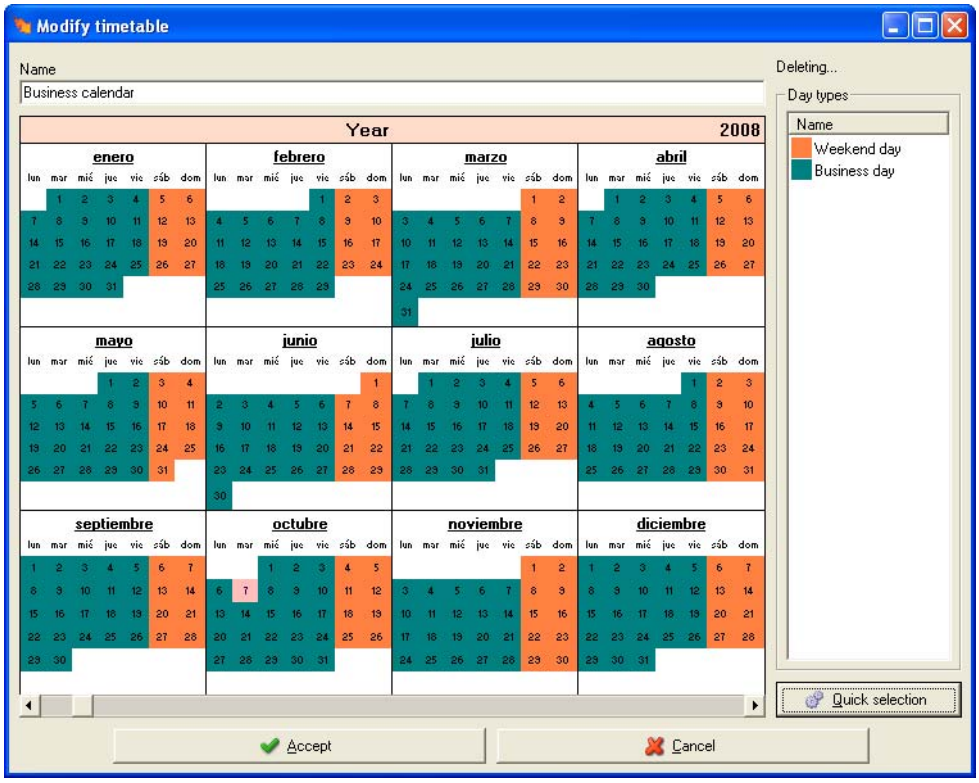


, in which case the event will not be disabled during this day.

10.1.3 Annual

This type of timetable corresponds to a calendar, where different types of days can be configured for several years.

As with the weekly type, the different types of day that may be selected correspond to different configured daily types.

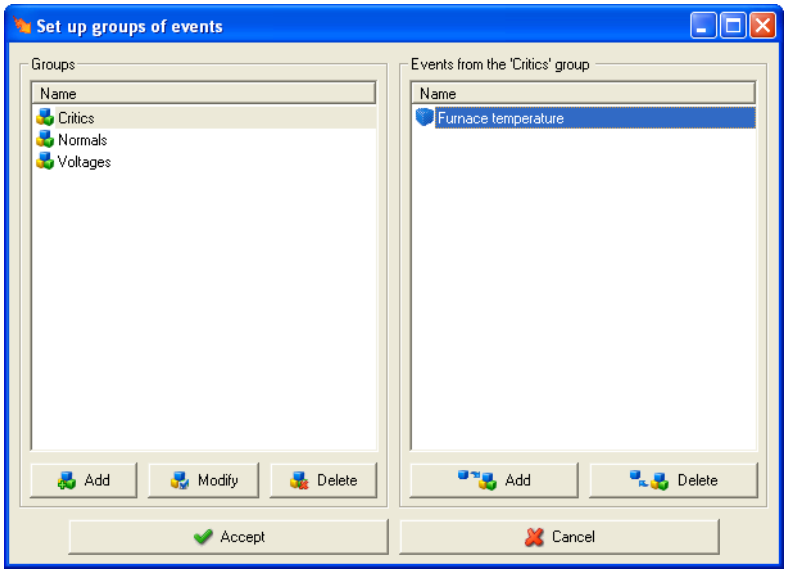


Alphanumeric type data which permits the type of year within the events timetable to be uniquely.

Calendar configuration is the same as that explained for the discriminator calendar (see 5.1.3 Calendar).

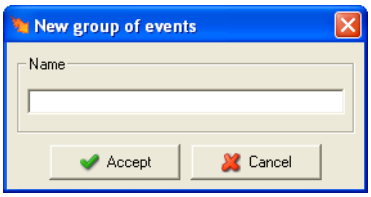
10.2 Event groups

For a better display when it comes to showing the event viewer, allowing us to filter and show only one type of event, the events can be classified into groups, allowing a single event to be allocated to more than one group. The option 'Groups of events' from the '*Set up* menu will allow the different groups of events to be configured.



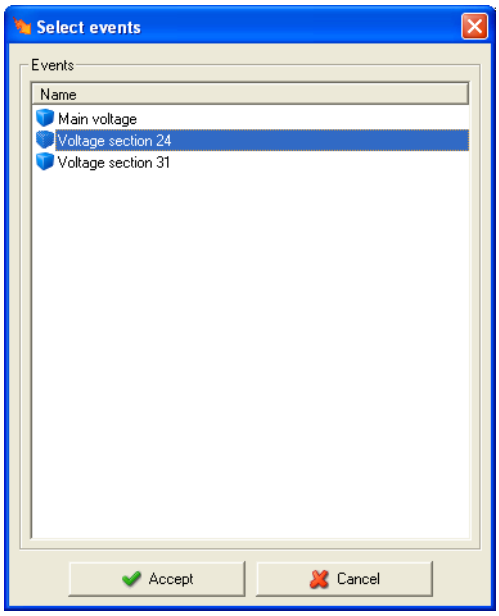
On the left-hand list all the configured event groups will be displayed, while on the list on the right events that have been assigned to the group selected from the list of groups will be displayed.

Allows us to add, modify or delete groups of events. On adding or modifying the following dialogue will appear:



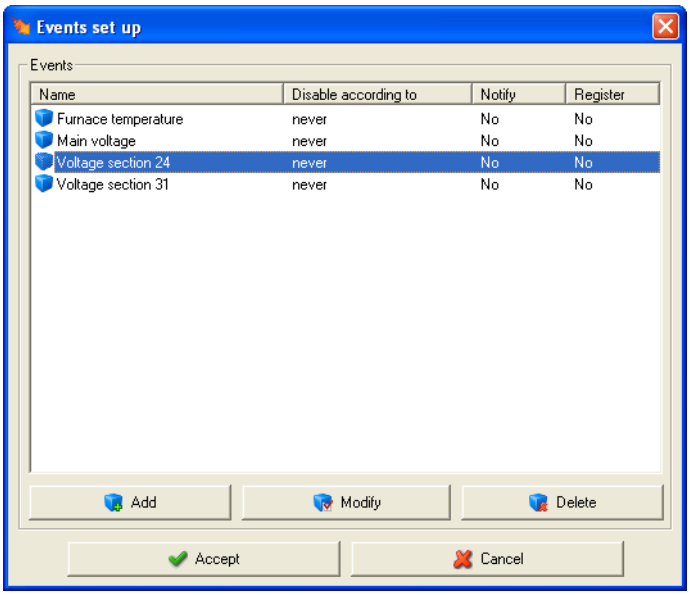
Where the name of the event is entered. This name will identify the group in a unique way.

Allows events from the group of selected events in the list of groups to be added or deleted. Delete a group event will only delete it from the group and in no case will it be removed entirely from the event set up. When you click the 'add' button a list with the events outside the group will appear, where the events to be added can be selected.


Select events
Events
Name
Main voltage
Voltage section 24
Voltage section 31
Accept
Cancel

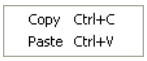
10.3 Event configuration

To add, modify or delete events, the 'Events' option from the "*Set up*" menu should be selected. The following dialogue box will appear:



Where configured events are shown, the disable timetable, whether it will be notified and finally registered.

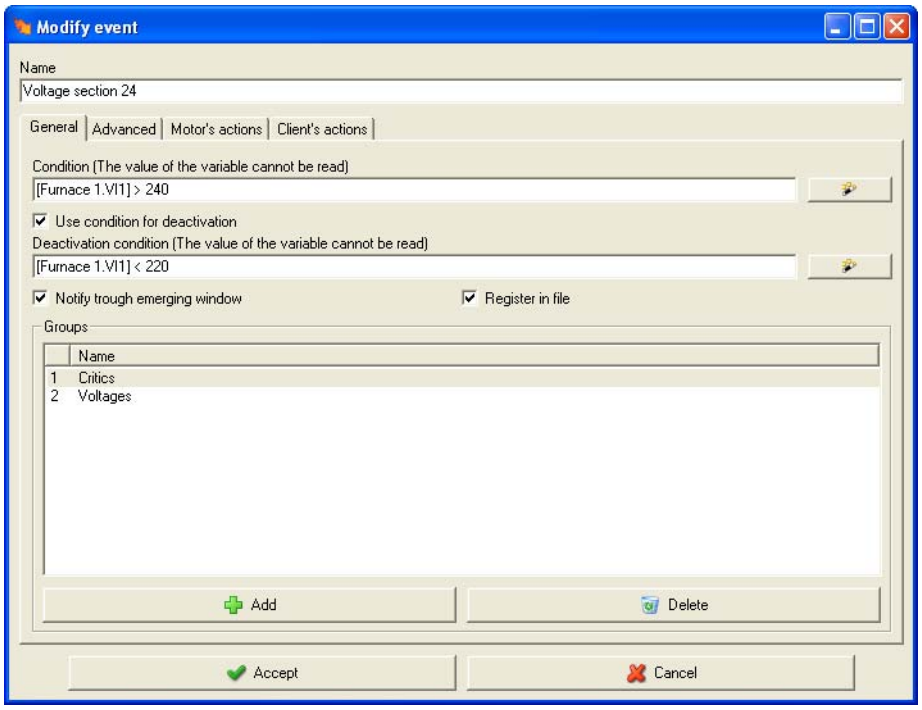
Clicking the right mouse button on the list of events the context menu appears.



Allowing events to be copied or pasted. It is possible that some of the options in the context menu do not appear, copy only appears if there are any events selected and the paste option only if these events have been copied to the clipboard. If no event is selected and there are no events on the clipboard on clicking the right mouse button the context menu will not appear.

Clicking 'Delete' will delete the events that are selected in the list of events.

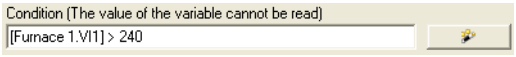
By clicking 'Add' or 'Modify', a new event will be created or an existing event amended. The following dialogue box will serve to create or modify an event.



The functions of this dialogue are specified as follows:

Name that uniquely identifies the event in the application.

Allows switching to be carried out between different event set up parameters. The previous picture shows the general configuration of an event.

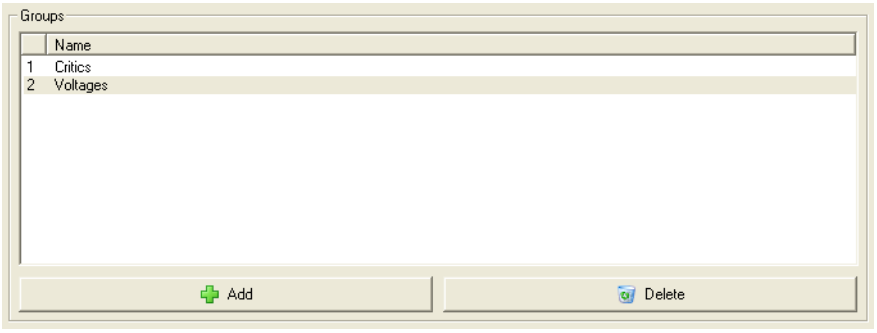


Condition of the event. The event will become enabled when the condition is true and will remain disabled on the contrary. This can be entered manually or using the "*wizard*" button (see appendix 14.2.1 Wizard for the creation of expressions and conditions).

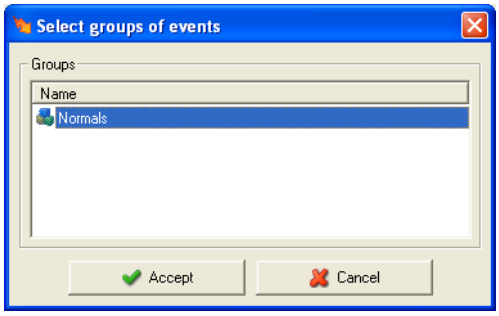
A condition for the deactivation of the event can be added, by checking ☑ or not ☐ this box this will indicate whether we want to use a prerequisite for disabling the incident. In this case the event will be enabled when the voltage exceeds 240 and is disabled at less than 220.

Checking ☑ or not ☐ , this box will indicate whether the incident should be reported or not. If the event is reported when the program is active a pop-up display will appear.

Checking ☑ or not ☐ this box will indicate whether the incident is registered or not, and therefore may be displayed in the events´ browser or not.

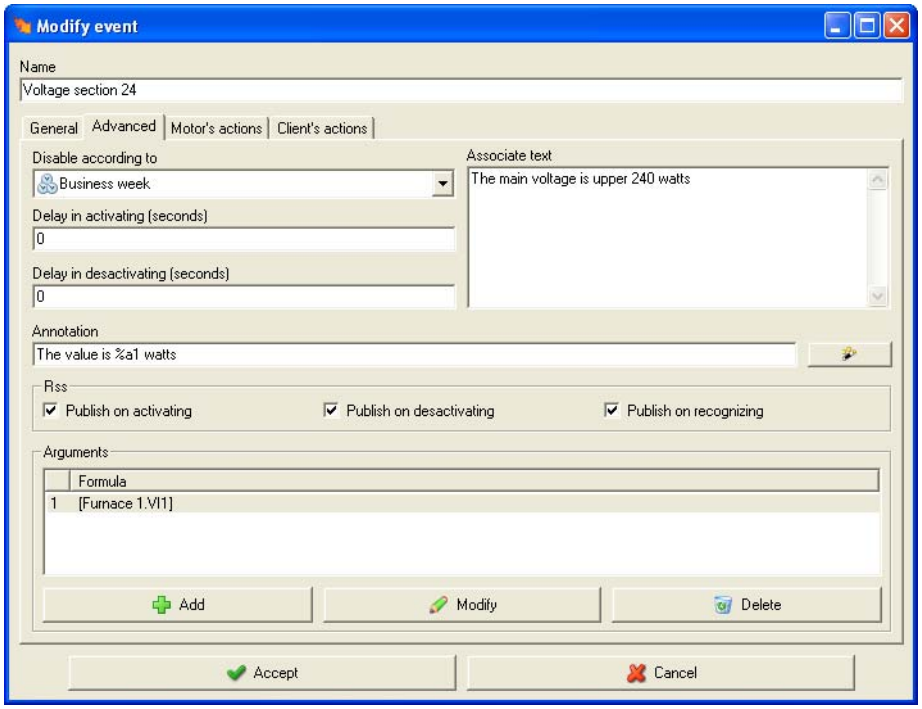


It shows the list of groups to which the event belongs (see 10.2 Event groups). Clicking on the 'Add' button brings up a dialogue with the list of groups that the event does not belong to, allowing the groups to be selected to which we want to add the event.

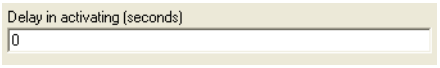


Using this dialogue groups are selected to which the event can be added, but are not currently added.

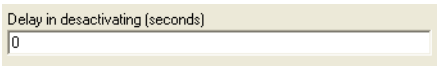
In the Advanced tab the following parameters appear



Allowing the disable timetable of the event to be selected. If no timetable is selected, the event will always be supervised by the application. If an event has selected a disable timetable, if the event is active and for calendar reasons it becomes disabled the event will be disabled.



This value corresponds to the delay in activating the event in seconds. The event will be enabled when the activation condition is fulfilled for at least the time shown in this field. For example: if the activation delay is 5 seconds, to activate the event the activation condition must be met for at least 5 consecutive seconds, if the conditions are met for 4 seconds, the event would not be enabled.

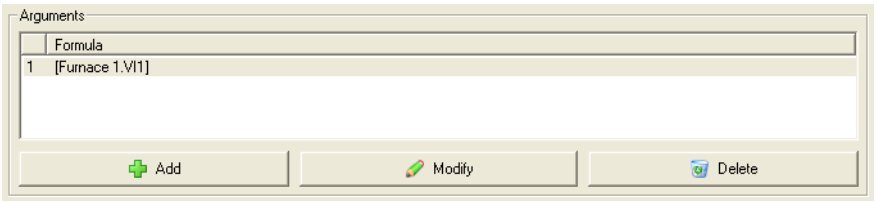


This value corresponds to the delay in the deactivation of the event in seconds. The event will be deactivated, if when enabled, the activation condition no longer fulfils at least the time shown in this field, in a similar way to the delayed activation.

Brief description of the event.

Allows an annotation to be configured which will be calculated when the event is enabled and which may serve, for example, to ascertain the value detected of a variable that has enabled the event. The annotations will be explained in more detail in section 10.3.1 Annotation.

Can be configured if Rss notifications are generated on enabling, disabling or acknowledging the event. In this case only the enabling and disabling of the event will appear. This option will only appear if the Rss of events on the software preference screen has been enabled (see section 2.2.12 Preferences)



The arguments will allow formulas to be configured for their use in event annotation and actions. These formulas are calculated at the time of their use, being useful to display the value which has provoked the event as shown in the example.

The engine actions tabs allow the actions for each state of the event carried out by the communication engine to be configured, while for actions in the client application those actions to be carried out by the client application are configured. The actions are explained in more detail in section in section 10.3.2. Actions

10.3.1 Annotation

The annotation of an event will correspond to a text, with a number of variable parameters which is associated with the activation of an event.

The parameters will be replaced by their corresponding value when the event is enabled, hence, for two different activations of a single event two different annotations may also correspond.

As previously discussed, one of the uses of the annotations is being able to register the value of a specific variable at the time the event is enabled, so we can display extra information in the event viewer.

Below are the different parameters that may be used in the annotation.

Parameter	Description
%n	Name of event
%c	Condition of the event.
%s	Condition for the deactivation of the event
%b	Delay in enabling
%e	Delay in disabling
%d	Name of disable timetable
%t	Text associated with the event
%gx	Group Name x, where x is the order of the group within the list of groups. The order will be displayed with a number to the left of the name of the group.
%ax	Argument x, where x will be the order of the argument within the list of arguments. The order will be displayed with a number on the left side of the argument. The arguments are explained in more detail in section 10.3.1.1 Arguments.
%%	Character%

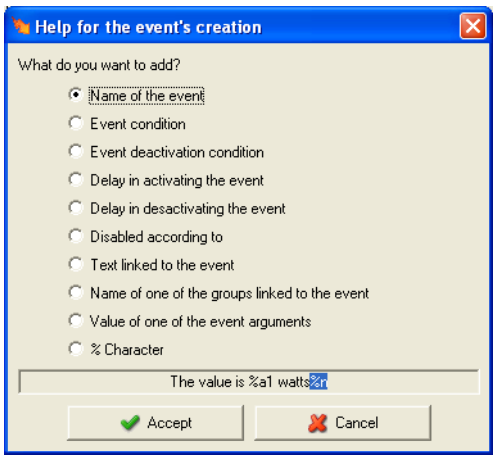
Each of these parameters will be replaced correspondingly when the event is enabled, for example if the annotation is:

Event name '% n' was enabled when the voltage marked %a1 V.

When the event is enabled the annotation created specifically for this activation will be:

Event name Main voltage was enabled when the voltage marked 256 V.

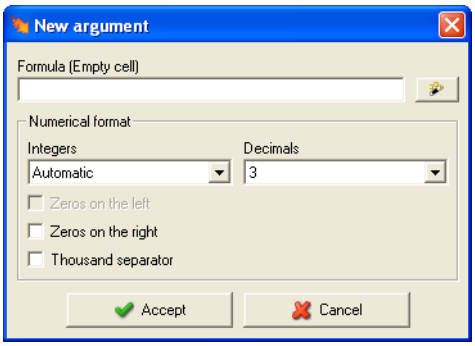
To facilitate the creation of the annotation, clicking on the button 'wizard' ; the following dialogue will appear:



Where you can choose what kind of parameter to be added to the annotation.

10.3.1.1 Arguments

For the creation of the annotation a series of arguments can be defined. Each argument will consist of a formula and representation format of the value of the formula, as can be seen in the following dialogue:



Both the formula and the numerical format were previously described in 7.2.1.5. Formula control.

When the event is enabled, if the argument is used to create the annotation, the programme will evaluate the formula and will represent it in accordance with the configured format.

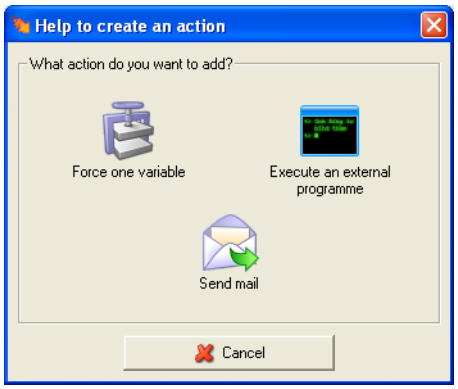
10.3.2 Actions

For each event it will be possible to define a series of actions to be taken in each event status. It will be possible to formulate actions both in the communications engine and for client application, however depending on the action it will only be possible on one of them.

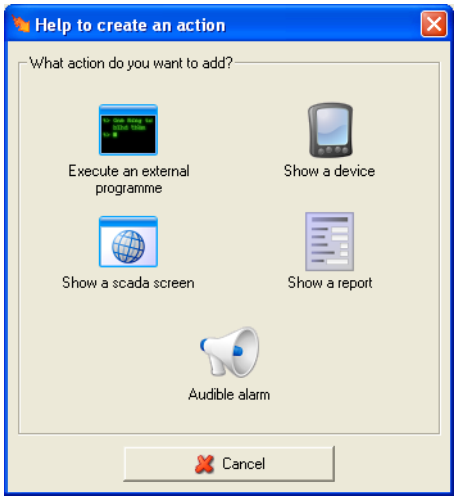
According to the state of the event the actions are divided into:

- *On activating:* These actions are executed only once when the event is enabled.
- *While active:* While the event is active, it will continuously execute this group of actions. Caution must be exercised in configuring actions, because they are running continuously they may block the system or connected devices.
- *On deactivating:* These actions are executed only once when the event is disabled.
- *When acknowledged:* These actions are executed only once when the operator recognizes the event. This group of actions will only be available when the event needs to be notified.

By adding an action in the engine the following dialogue will appear:



Whereas if you want to add an action to the client the following will appear:

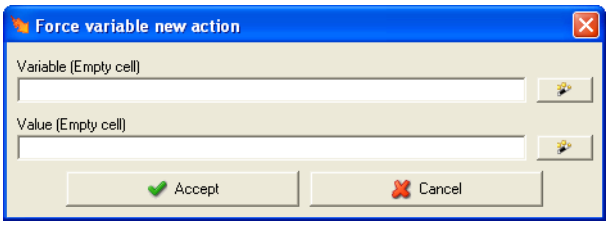


As can be seen actions that can be made by the engine are different from those that can be made by the client application. Bear in mind when adding actions, where we want to carry them out. Once the action has been selected the corresponding window will appear for the configuration of these actions.

Because there are incompatibilities between actions, for example it is not possible to show a device and a screen at once, by adding more than one action the non-compatible actions will not appear with those already added.

10.3.2.1 Forcing a variable

This action can only be done on the communications engine. It allows the value of a variable, such as a digital output or a counter to be changed.

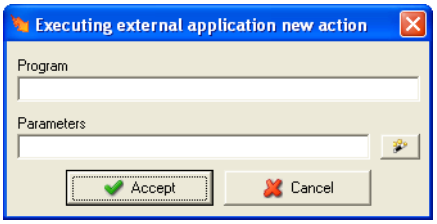


To configuration the action an expression must be entered, which corresponds to the variable you want to force, and another expression that corresponds to the value at which we wish to force the variable.

Both the variable expression and the value could be entered manually or using the corresponding '*wizard*'

10.3.2.2 Running an external program

This action may take place in both the communications engine and on the client application. This allows an external application that is present in the system, such as listening to an audio file.

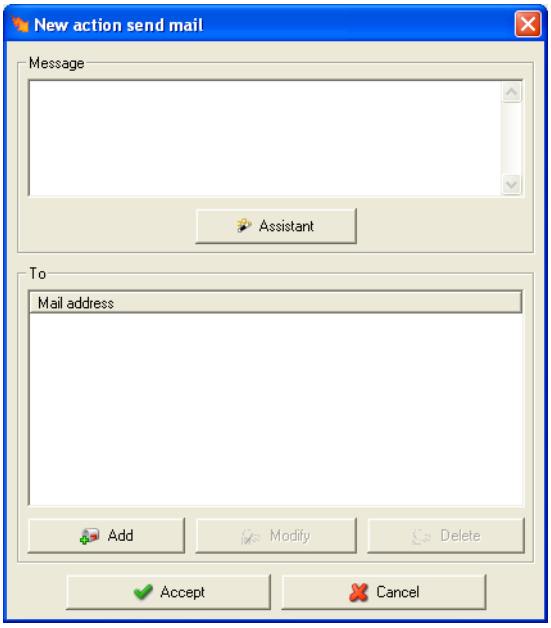


For correct operation it is advisable to indicate in the "Program" field the complete directory where the programme can be found in order to enable the engine and the client application the localisation of the application required to be carried out.

In the 'parameters' field the parameters necessary are written for the execution of the external application, using the arguments configured in event (see section 10.3.1 Arguments)

10.3.2.3 Sending Mail

This action can only be done on the communications engine. It enables an electronic mail to be sent to the selected addressees.



In this dialogue the message to be sent in the mail is entered. The format of this message is similar to the event annotation (see section Event set up) allowing any of the arguments configured in the event to be used. To facilitate entering the message the wizard can be used by clicking the button.

At the bottom a list of recipients to whom the mails will be sent appears.

For more information on how to configure the mail server see section 2.2.12 Preferences.

10.3.2.4 Show a device

This action can only be done on the client application. In conducting the action, the client application will automatically display the selected screen monitoring device.

10.3.2.5 Show a SCADA screen

This action can only be done on the client application. In conducting the action, the client application will automatically display the selected SCADA screen.

10.3.2.6 Show a report

This action can only be done on the client application. In conducting the action, the client application will automatically display the selected report.

10.3.2.7 Sound Alarm

This action can only be done on the client application. On conducting the action, the application will emit a bleep.

10.4 Event Variables

Each of the events has an associated number of variables that can be used in SCADA screens, reports, graphs and tables.

Using these variables it will be possible for example to know the status of the event on a SCADA screen or the number of activations of the event in a report.

The number of variables associated with each event may vary depending on whether the event is reported or is stored in the event log.

The event variables will be coded for use in formulas and expressions such as:

R$EVE_variable. name

Using the R$EVE prefix the program will ascertain that this is an event variable rather than a device variable.

This codification can be used in formulas, graphs and tables, although in the case of reports, graphs and tables only the variables of those events that are recorded on file can be displayed.

To obtain more information about the event variables see section 14.1.14 Event variables

11 DDE – Dynamic Data Exchange

Any Windows based application which has DDE functions can establish Dynamic Data Exchange links with PowerStudio.

The DDE (Dynamic Data Exchange) is a Windows protocol between applications. The client mode can be used (Request data from other applications) and / or server mode (supply data to other applications). The PowerStudio program operates in the server mode, that is, once communication is established with another Windows application (Excel, Paradox, Word, programs in C, Visual Basic, etc.). PowerStudio supplies this with the values read on the drivers. For example, voltage, current, etc. can be seen in real time in Excel.

Those applications that allow a value to be forced through the DDE may modify a parameter of the driver, such as digital outputs, internal records, etc.

The DDE communication established has the following characteristics:

☞ The link established is the *"hotlink"* type. i.e, PowerStudio warns the client applications when the data has changed and the latter will request it if necessary:

☞ The program can send data via DDE to several applications, the only limitation is the memory capacity of the PC.

☞ For each client a link is established for each of the variables requested.

☞ The DDE protocol consists basically of three elements: The ***Conversation***, the ***topic***, and the ***item***.

Conversation *Conversation* is a text that distinguishes whether the applications must be unique per application. This allows no cross questions and answers from various applications. In our case: "**PWSTDValues**." For example "**=PWSTDValues**|Device1!VI1".

Topic The *Topic*, as with the *Item*, does not have a specific meaning, it depends on the use of each application. For the PowerStudio programme, the *Topic* identifies the device from which information is sought. For example "**=** PWSTDValues | **Device1**! VI1." When the device name contains spaces (Device 1), it must be indicated between single commas(‘) "**=** PWSTDValues |’ **Device 1** '! VI1

Item The *Item* is the element that the applications request, phase voltage 1, frequency, status of the relay, etc. For example "=PWSTDValues|Device1!**VI1"**.

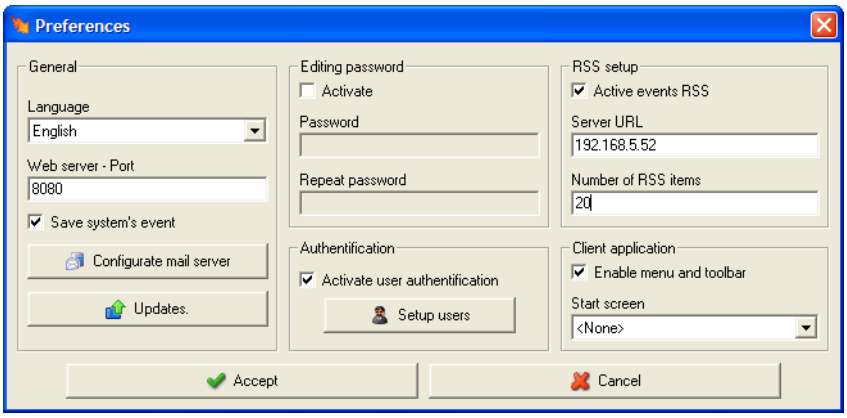
In appendix 14.1, Variables, the expression is detailed which should be used to access the device variables.

12 Access through the PowerStudio Client

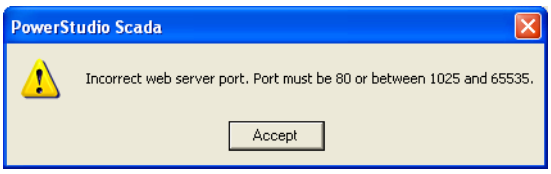
The software has a client application that will allow users to access SCADA screens, reports and to display the instantaneous values being measured by devices either locally or through a remote connection. Graphs can also be made, access to value lists recorded by the devices, viewing events, seeing the status of devices, etc. Similarly this client application is available by embedding as an Applet on the website of the application.

12.1 Web Server

The communications engines acts as a Web server configured in port 80 by default. It is possible to host that server in another port through the corresponding option in the ‘set up’, menu and 'Preferences' submenu.

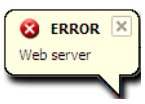


In ‘*Web server - Port*’ the port will be specified that is enabled for accessing the remote computer. By default the value is 80, although it may be altered at will. The programme will warn if the value entered is not correct.



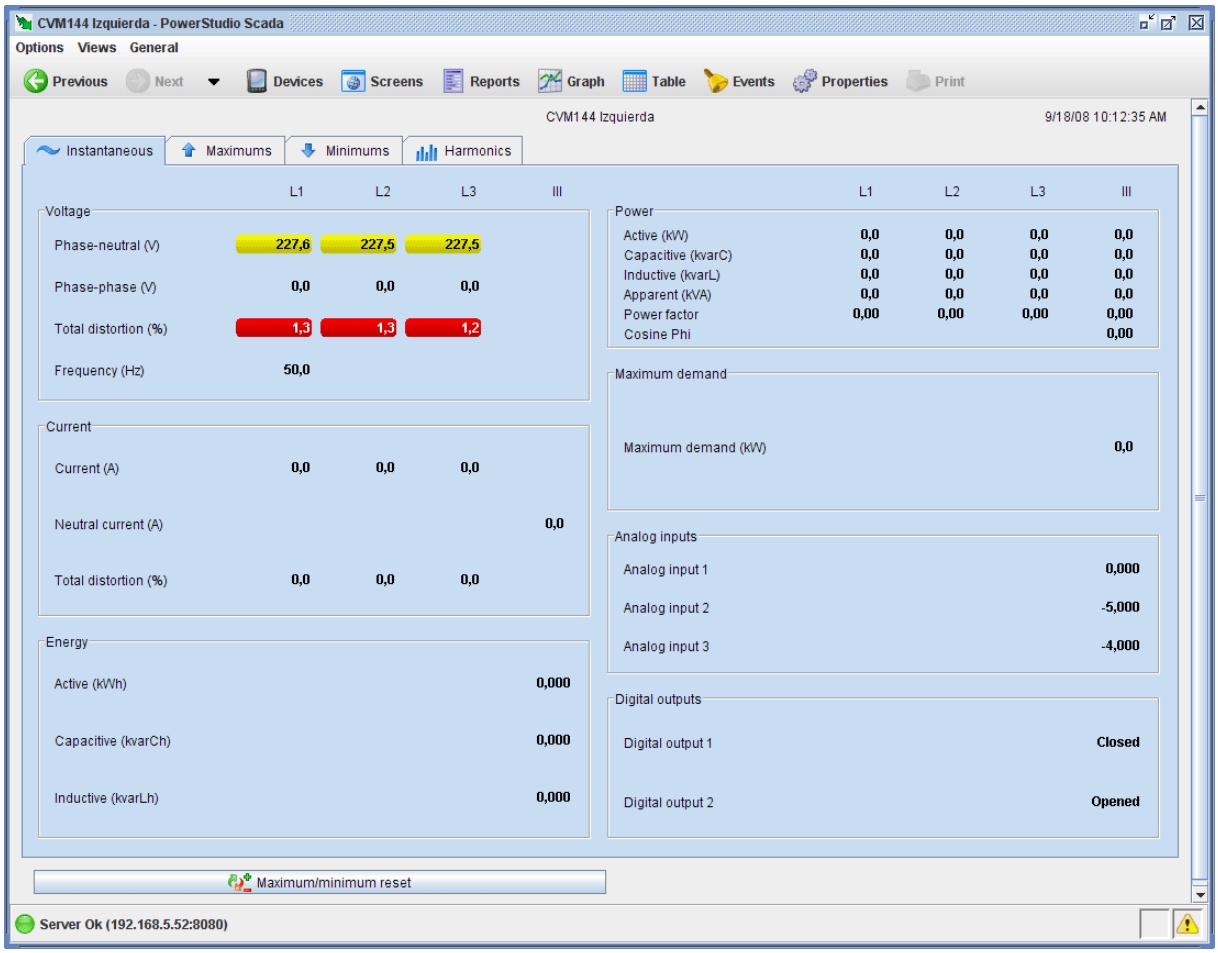
N.B: The default port 80 should remain as such and it must not be the PC itself where the programme is executed whether there is a Web server or another application making use of this port. In such a case any other available port should be configured. If the communications engine was unable to execute the web server the following warning icon would appear on the status bar (bottom right):

If the application is minimized in the execution mode and the web server is unable to start, the following warning will appear in the status bar of Windows:

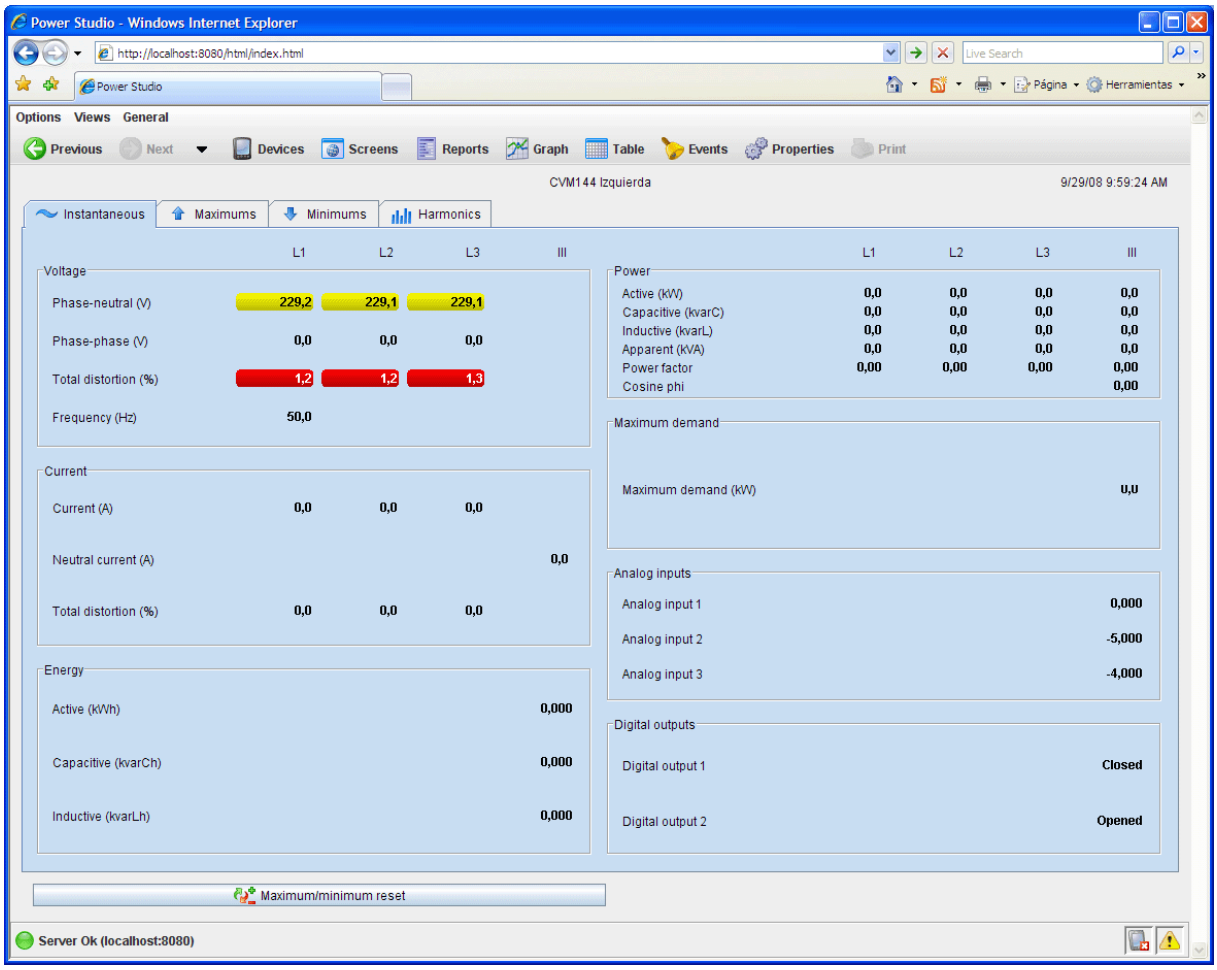


N.B: If the box ‘Activate user authentication’, is enabled all access restrictions to device value screens, SCADA screens, etc. It will be applied to the remote user application trying to access them either through the client provided or the embedded client application in the webpage such as a Java applet.

N.B: It is necessary to switch over to the 'Run' mode for the Web server to be enabled and so it can be accessed through the client application provided or through the applet embedded in the website.



Client application



Client application embedded as applet in the application web page

12.2 Client

The client is in charge of viewing all the information generated by the communications engine and the resource editor. The client is an independent programme of the platform as it is implemented in Java and therefore, it can be executed in different environments as long as the Java Virtual Machine is installed in the 1.6.0 version or later. Similarly, the client can be executed in the Windows, Linux, Unix, Mac or OS/X environment.

The client can be executed both as a local application (AppletScada.jar) and in the form of an embedded applet on a downloadable web page directly from the address where the engine/editor is installed. In this last case browsers such as Internet Explorer (version 6.0 or later), Mozilla Firefox (version 1.5 or later), Opera (version 9 or later) and Netscape Browser (version 8 or later) can be used. It is possible however, that the client application works on other browsers or on previous versions of the officially supported browsers.

The client application is designed with a similar philosophy to that of a web browser. This means that the program manages a series of views (or web pages on a browser), maintaining them on a list and enabling access to the same in different ways.

Client application with a SCADA screen as an active view

As can be observed on the previous image, the client mainly consists of 4 differentiated areas, the uppermost menu bar, the toolbar directly below it, the active view, the centre and the status bar, on the lower part. On the title of the window, the name of the view is being visualised at that moment.

The menu bar contains all the options available on the client application, browsing through the views, direct access to them, general options, etc. The toolbar contains fast and direct access to the most important options at any moment. The present view contains the visualisation of the active resource at that time, whether it is a SCADA screen, a report, the status of the devices, etc. The status bar contains general information on the application, indicating the status of communications

with the server (engine / editor), the status of communications with the equipment, the active events, etc...

12.2.1 Status Bar

The status bar of the client contains general relevant information about the application, such as the status of communications with the server (engine / editor).

Status bar communicating correctly with the server

If the client application has established a connection with the engine / editor, on the left side of the bar you'll see a green indicator and a text stating that the server is active and communicating correctly through the address and port given. If the customer cannot establish the connection with the server (engine / editor) this will also be indicated.

Status bar not communicating with the server

The fact that the client is unable to establish such a connection may be due to the following causes:

- *The IP address or port is incorrect:* The IP address or port the client is addressing for the server is not correct, check what the IP address is and the port where the engine / editor is configured.
- *The engine /editor is not running:* Make sure the server program, namely the engine / editor, is running on the machine the client application is trying to connect to.
- *The engine /editor is not in running mode:* Make sure the engine / editor is in the running mode as in the edit mode communication will not be permitted.
- *The engine / editor is not enabled as a web server:* Make sure that the engine / editor has managed to boot the web server on the specified port.

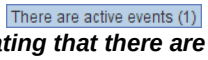
Apart from these indications, the status bar will inform about the status of communications with devices defined in the program, indicating whether there is any impact on communications with any device using the corresponding icon on the right side of the status bar, specifically in the left square.

Status bar communicating with the server but with errors in communication with the devices and active events

The incidences in communications are transmitted by two icons:

- **Error in communications:** There has been some kind of error in communications, either because of a device or a connection. This icon encompasses several individual incidences, as detailed in "Status of the devices."
- **Devices not started up:** There are devices with which it has not been possible to establish communication yet and which are unknown.

Similarly the icon corresponding to the square on the right informs us if there are active events in the application. In this case, moving the cursor over this icon a message will appear indicating how many events are active at that time.



Message indicating that there are 6 events active

Both for indicating communication problems with devices and active events, double-click on the icon in question to inspect the view associated with more detail. In the first case we will go to the

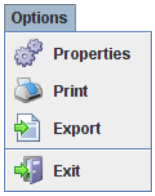
view of the device status and in the second case the window where events will appear. Both the view of the status of the devices and the active events window will be discussed later in fuller detail.

N.B: The status bar can be hidden by the corresponding option in the client application menu, specifically on the "*General*" option. Similarly it is possible to avoid it appearing with the option "Enable menu and toolbar" option in the "Preferences" Engine / editor option. In the latter case it will not be possible to make it appear again from the client application.

12.2.2 Menu Bar

The menu bar, located at the top, provides access to all features available on the client. This bar has three main menus, "Options", "Views" and "*General*".

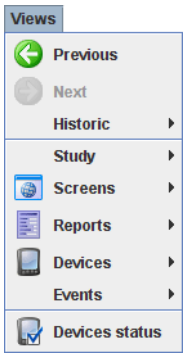
The "Options" menu consists of the following sections:



Options menu

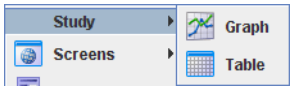
- **Properties:** Provides access to the properties of the currently active view. This option can be active or not depending on the view in progress.
- **Print:** Print view currently active. This option can be active or not depending on the view in progress.
- **Export:** Exports currently active view. This option can be active or not depending on the view in progress.
- **Exit:** Exit the client. This option is not available when the client is embedded on the website of the application.

The "Views" menu consists of the following sections:



Views Menu

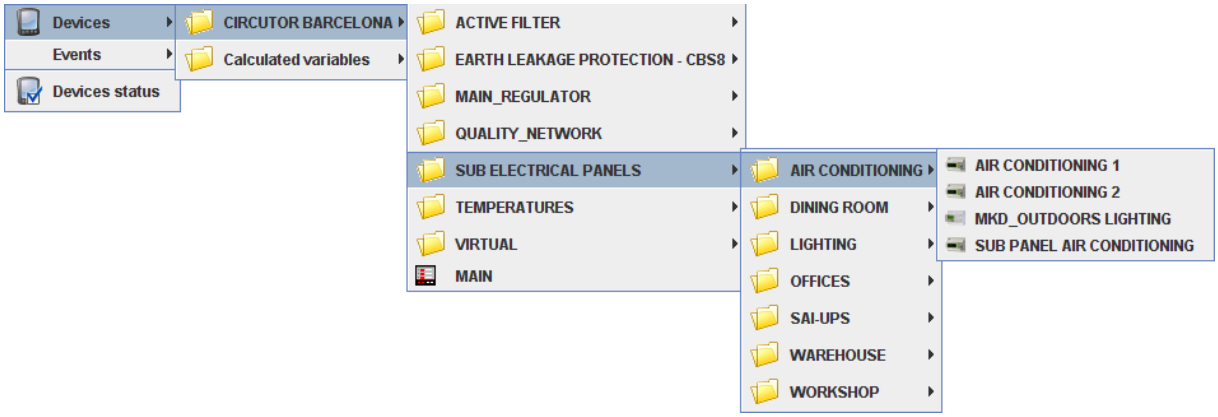
- **Previous:** Allows the previous view to be accessed.
- **Next:** Allows access to the next view.
- **Data log:** Allows immediate access to any logged view.
- **Studio:** Gives access to graph and tables views.



Study Menu

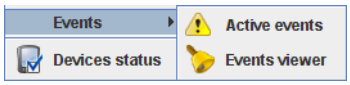
- **Screens:** Allows direct access to one of the SCADA screens defined by the user in the engine / editor in the edit mode.

- **Reports:** Allows direct access to one of the user-defined reports on the engine / editor in the edit mode.
- **Devices:** Allows direct access to the monitoring device view of a particular device through the device tree.



"Devices" Menu

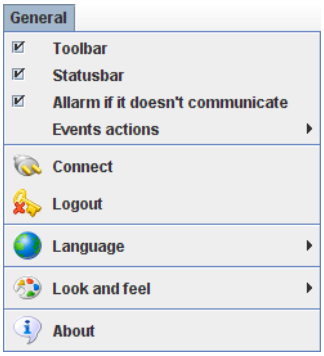
- **Events:** Allows access to both the logged view of events and the active events window.



"Events" Menu

- **Status of devices:** Gives access to the view of the device status.

Finally, the "*General*" menu consists of the following options:



"General Menu"

- **Toolbar:** Lets the toolbar be shown or hidden.
- **Status bar:** Lets the status bar be shown or hidden.
- **Alarm if it doesn't communicate:** Allows you to set whether an alarm should sound when there is a server or not.
- **Events actions:** Lets us decide which types of actions associated with the events we would like to run on the client and which not.
- **Connect:** Connects with another server changing the IP address and / or the port.
- **Logout**: Allows the current session to be closed. Only available when the user has connected to a server that requires authentication.
- **Language:** Changes the language of the client application.
- **Look and feel:** Lets the appearance of the client application to be changed (Skin).
- **About:** Allows access to information about the client application.

N.B: There is a possibility of hiding the menu bar using the option "Enable menu and toolbar" in the "Preferences" option of the engine / editor. In this case it will not be possible for it to appear again from the client application.

12.2.3 Toolbar

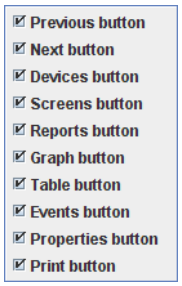
The toolbar allows the user more direct access to the most important options at all times.

Toolbar

Thus, this bar offers the following options:

- **Previous:** Allows us to access the previous view.
- **Next:** Allows us to access the next view.
- **Down Arrow:** Allows us direct access any logged view.
- **Devices:** Allows direct access to the monitoring device view of a particular device through the device tree.
- **Screens:** Allows direct access to one of the SCADA screens defined by the user in the engine / editor in the edit mode.
- **Reports:** Allows direct access to one of the user-defined reports on the engine / editor in the edit mode.
- **Graph:** Lets us make a graph.
- **Table:** Lets us make a table.
- **Events:** Gives access to the historical events view.
- **Properties:** Gives access to the properties window of the current view.
- **Print:** Allows us to print the current view.

It is possible to configure the buttons we want to be visible or not through the context menu of the button bar. This menu is accessed by clicking the right mouse button on the toolbar.



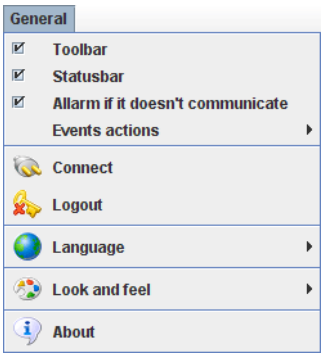
Toolbar setup menu

On this menu we can define what buttons we want to show and hide.

N.B.: You may hide the toolbar completely through the main menu option within the "*General*" menu. There is a possibility of hiding the menu bar using the option "Enable menu and toolbar" in the "Preferences" option of the engine / editor. Using this latter method it will not be possible to make it appear again from the client application.

12.2.4 General options of the client application

The client application has some general options that allow enhanced customization, as well as the configuration of some general aspects. These functions are accessed through the "*General*" menu of the application.

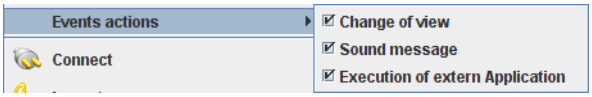


"General Menu"

The options "toolbar" and "Status Bar" permit, as discussed previously, respective bars to be shown or hidden.

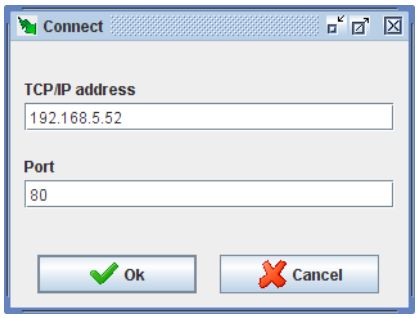
The option of "Alarm if doesn't communicate" indicates whether the client application should make an audible alarm sound when the engine is communicating or not. Typically the audible alarm consists of a series of consecutive beeps that last while attempts to connect to the engine are unsuccessful.

The option "Events actions" lets us define what type of actions can be made on the client application and which cannot in response to enabling, disabling or notification of events. View changes may or may not be made or sound messages or external applications may or may not be executed.



Menu event actions

The option of "Connect" indicates to the client application which server they must connect to. By clicking on this option the following window will appear:

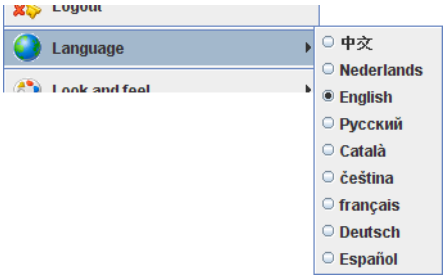


Connection window to a server

As shown in this window we can show the IP address of the server we want to connect to and the port as well. The IP address can be numerical, as in the example above (XXX.XXX.XXX.XXX) or the web address directly (www.midireccion.com). If we accept, the client application verifies that the data entered is syntactically correct and tries to connect to the server using the specified address. The previous connection will be lost because the client is always connected to a single server. This option is not available when the client application is embedded in the website of the application as an Applet since this only permits connections with the machine from where it has been downloaded.

The option “Logout” allows us to leave the session in which the user is authenticated at the time. This option appears only if the authentication on the engine is enabled and the user correctly enters the required user name and password at some point.

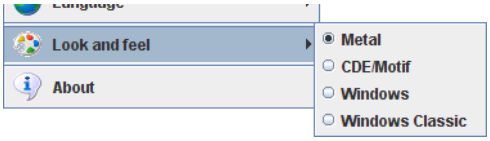
The option of "Language" allows you to change the language of the client.



”Language” Menu

The languages available are provided by the engine / editor. On executing the client application and connecting to the server (engine / editor) the list of available languages is requested as well as texts relating to the local language of the machine where the customer is running. If the server does not have the client language it will request the texts relative to the language in which the server is configured.

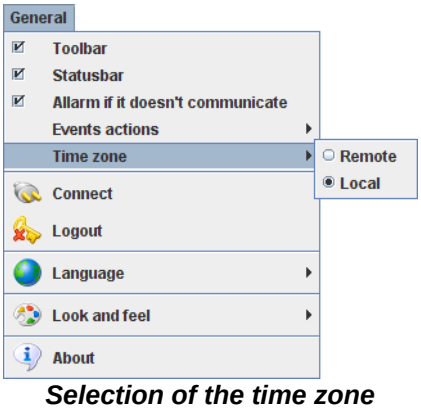
The option “Look and feel" allows you to customize the appearance of the client application windows and the interface generally.



“Look and feel” Menu

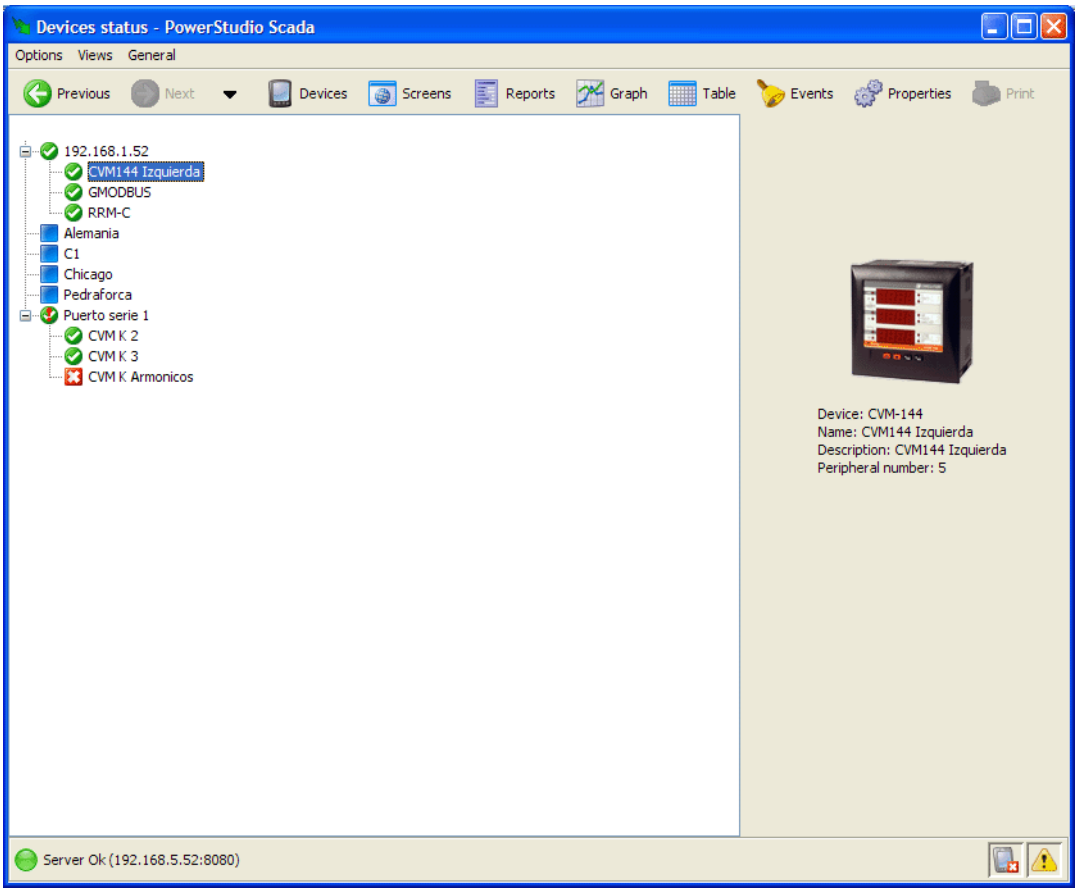
The first time the client application runs it does so under a "*Metal*" appearance which is available for any environment where it runs. However, depending on the environment, other aspects of the application will be available and the user can even install others from options available on this menu.

It is possible that the user is viewing engine data from a PC that is in a different time zone to that of the engine. By default, the data is shown referenced to the time zone where the client application is running (local), but from the client application, in particular the "Time Zone" option of the "*General*" menu, we can change this configuration to show the data referenced to the time zone where the engine is (remote).



Selection of the time zone

If the engine time zones and the client application coincide the option will not appear.



View of the status of the device with the Windows application aspect

The "About" option provides general information about the client, such as the version, manufacturer, etc.

12.2.4.1.1.1.1 Displaying SCADA screens

One of the most important features of the client is its ability to display SCADA screens defined and designed in the engine / editor, both local and remote. You can display any SCADA screen defined using the menu option "Overviews" and then "Screens" or directly from the "Screens" button on the toolbar. However, when the client application connects to a server, the client will automatically show the initial screen defined by the user on the server or if this is not specified, the first SCADA screen from the list of defined screens.

SCADA screens basically consist of a background image (which may or may not exist and is therefore white) and a series of controls placed on them. The information provided by a SCADA screen is updated on an ongoing basis. It acts on the basis of two main types of controls, those displaying some kind of data and those which require or allow user intervention.

The display controls simply show information on the screen. There are various types of information which may or may not vary over time depending on the type of control. For example, a formula varies over time depending on the values of the variables that make it up, and conversely a static image is always fixed. Display controls are:

- Text control
- Image control
- Date Control
- Formula control
- Floodfill Control
- Conditioned control
- Dynamic image control

To ascertain the scope and detailed operation of these controls see the editing SCADA screens section.

Action controls allow the user to operate them by clicking on them. It is easy to know when we are on a control action since the mouse cursor will change and assume the shape of a hand with the index finger extended, rather than the typical arrow.

The typical action control lets you change your SCADA screen and provides a simple and intuitive way to navigate through the designed application. Action controls are:

- Screen control
- Report control
- Device control
- Graph / table Control
- Active events control
- Event view control
- Execution Control
- Forcing variables control

To ascertain the scope and detailed operation of these controls see the editing SCADA screens section.

All features of a SCADA screen are contained in the same and are fully dependent on the design that the user has used when defining the controls used.

12.2.5 Displaying Reports

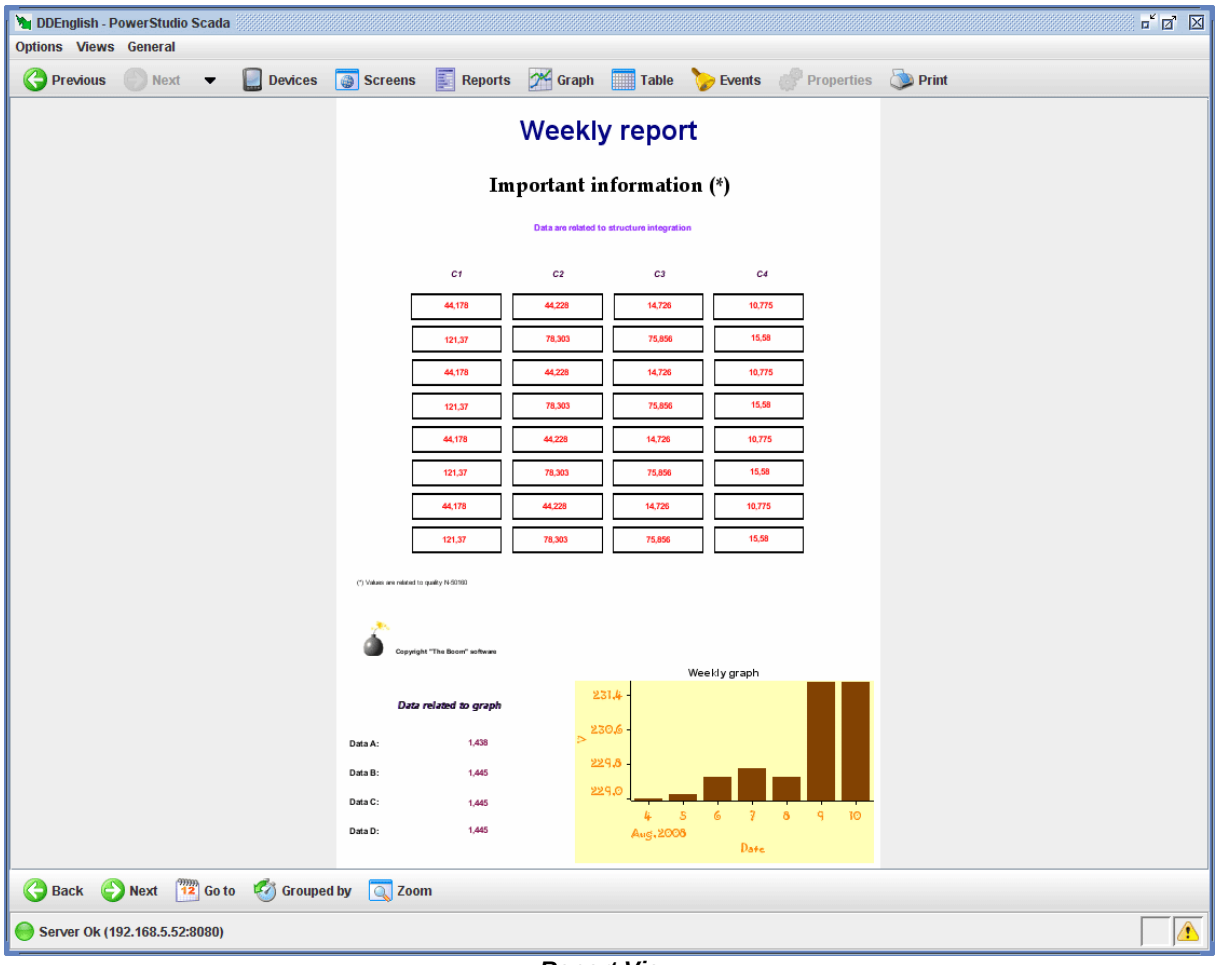
Another of the prominent features of the client application is being able to see reports defined and designed in the engine / editor both local and remote. You can display any report defined using the menu option "Views" and then "Reports" or directly from the "Report" button on the toolbar. It is also possible to access a particular report from a SCADA screen where a control report has been added, which will aim directly to the report defined.

The reports consist essentially of a series of pages and each page consists of a background image (which may not exist and hence be white) and a series of controls placed on it. The controls available in a report are as follows:

- Text control
- Image control
- Date Control
- Control formula
- Conditioned control
- Graph Control

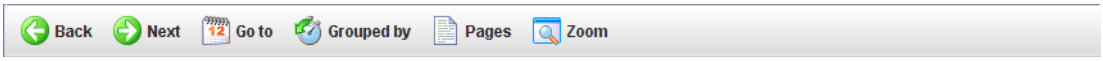
To know the scope and detailed operation of these controls see the editing reports section.

The information provided by a report is always related to a period of time and will only be updated in response to changes in this period by the user via the lower toolbar.



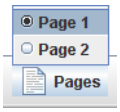
Report View

Unlike a SCADA screen, in a report there are no active controls that react to user actions, so that interaction with the report reduces the options available in the menus or toolbars, especially the lower toolbar, which is typical of this type of view.



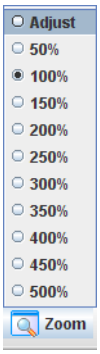
Toolbar for reports

From the toolbar we can access the page of the report we want, using the “Pages" buttons. This option does not appear if the report consists of a single page.



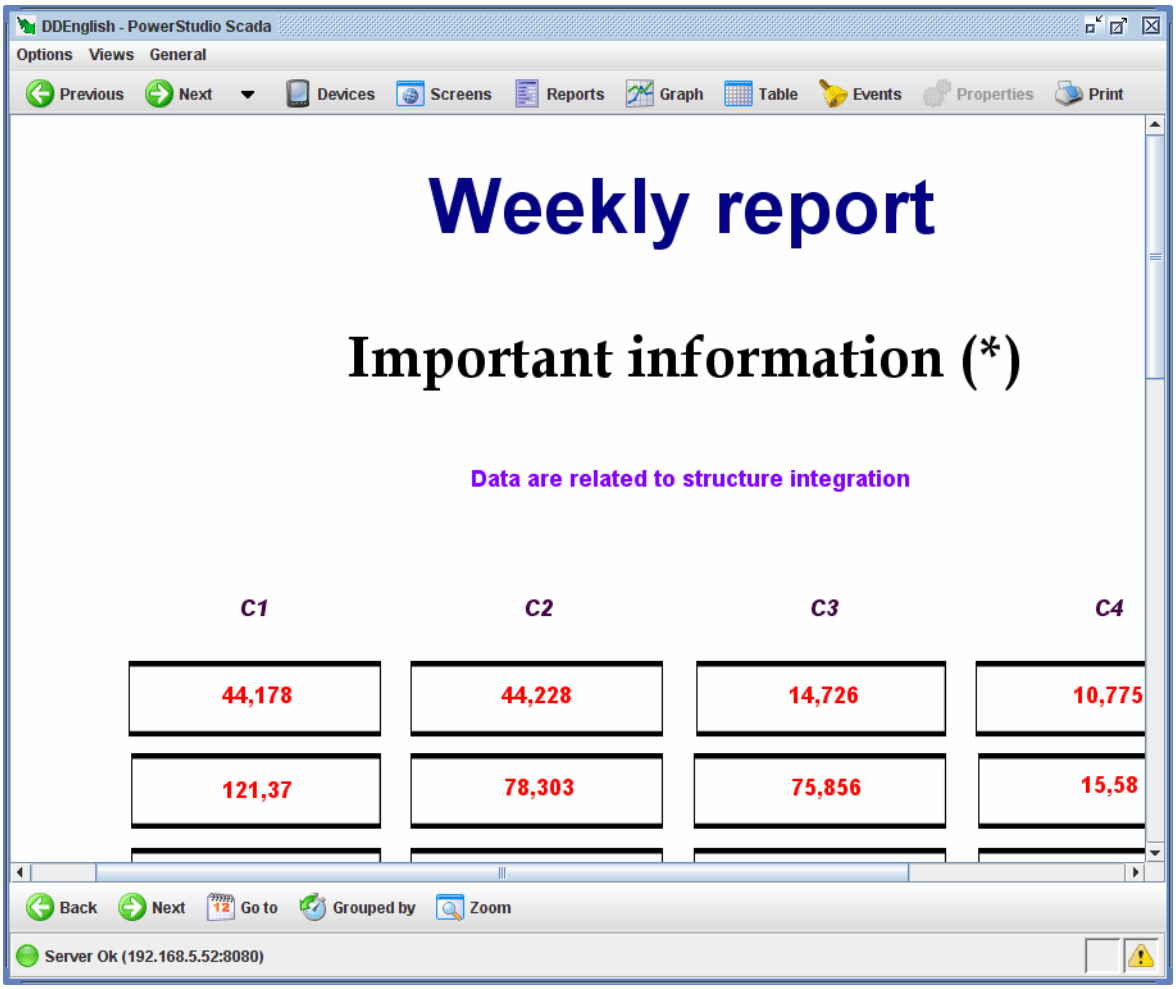
Pages Menu

Each page of the report can be expanded or reduced by the "*Zoom*" button on the bottom toolbar.



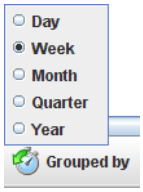
"Zoom” Menu

The option "Adjust" makes the current page fit completely into the active view maintaining the ratio aspect. If we choose an option that causes the page not to fit into the view, scrollbars will appear to enable us to move around the actual page.



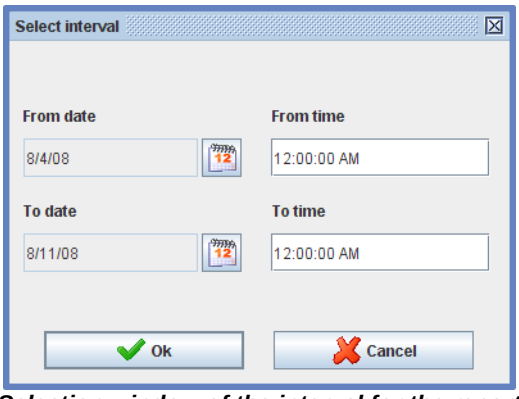
View of the report with a 150% zoom

The user can change the grouping period referred to the report at any time. This is carried out using the "Grouped by" option on the toolbar.



Grouped by Option

As can be seen, the application provides quick access to daily, weekly, monthly, quarterly and annual reports. If the user wishes to make a report of a period that is not included in any of those pre-defined, it can be done by selecting the "Go" option on the toolbar.



Selection window of the interval for the report

In this window the user can exactly specify the period over which you want to make the report. Thus, the user could, for example, make a report of the first 5 days of a month, or the first 6 hours of a day, and so on.

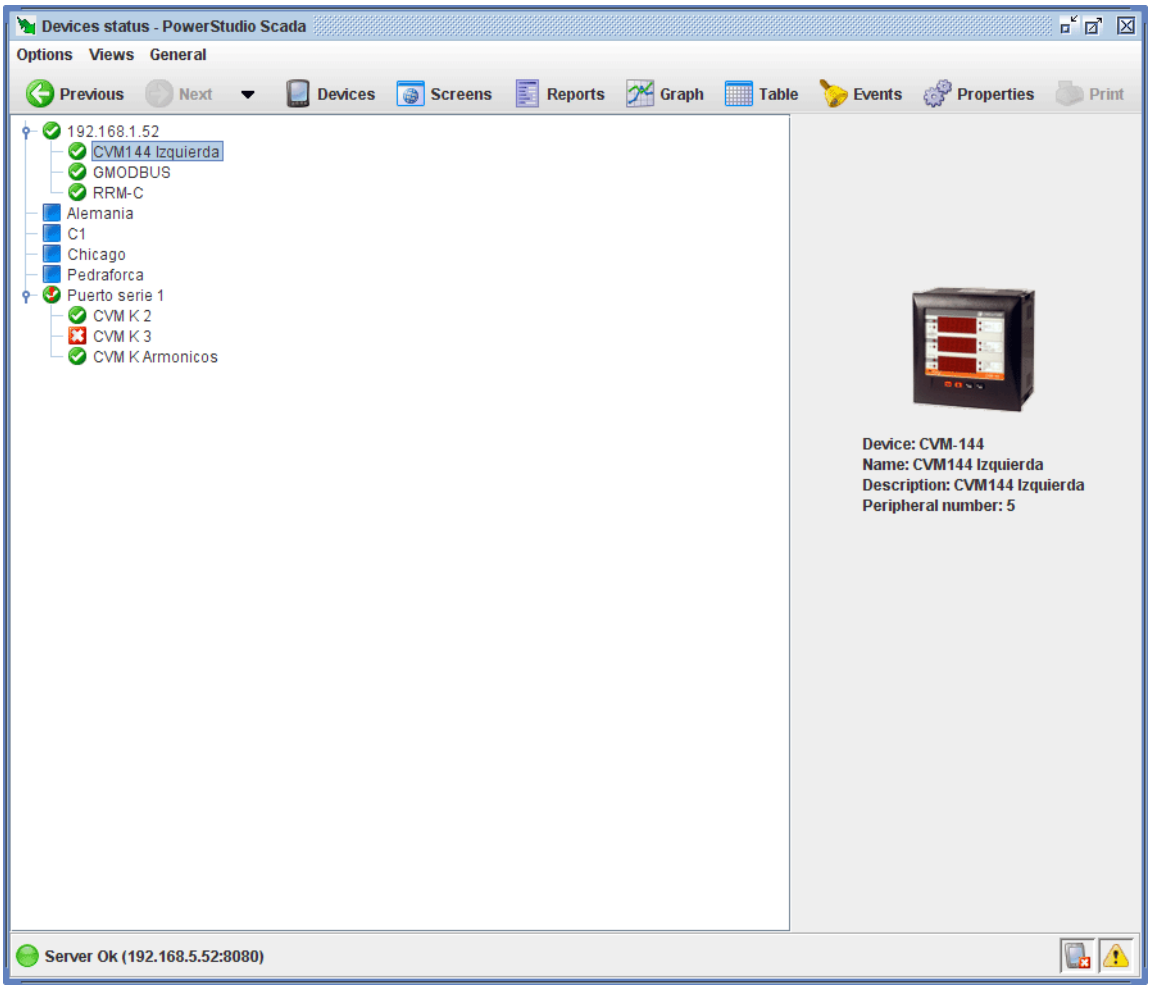
Irrespective of the period over which the report is made, the user can scroll to the previous period or next (if any), this is done using the buttons "*Back*" and "*Next*" in the toolbar below. Thus, if we are grouping by day, the button "*Back*" takes us to report the day prior to the current one or, if we are bringing together a week, the "*Next*" button will take us to the report for the following week.

The user can print the actual page of the report at any time using "*Print*" in the menu "*Options*" of the main menu or the "Print" button of the upper toolbar. Note that this option, unlike the SCADA screens, is enabled for reports.

12.2.6 Displaying the status of devices

The client application offers the opportunity of checking the status, where communications are concerned, of the devices connected to the engine / editor both local and remote. The view of the status of devices can be viewed through the menu option "*Views*" and then "*Status of the devices*." It is also possible to access this view using the status bar by clicking on the icon that indicates that there are errors in communications only when there are incidents.

This view consists of a tree which details the status of all the devices connected to the engine / editor. The default representation of this tree is a series of father nodes that represent the equipment connected directly to the PC where the search engine is running, from where a series of sons nodes which represent the equipment connected to the device are rooted.



View of the status of the device per connection

Each node has an icon which represents the status of the communications of the equipment. Thus, we find the following states are possible:

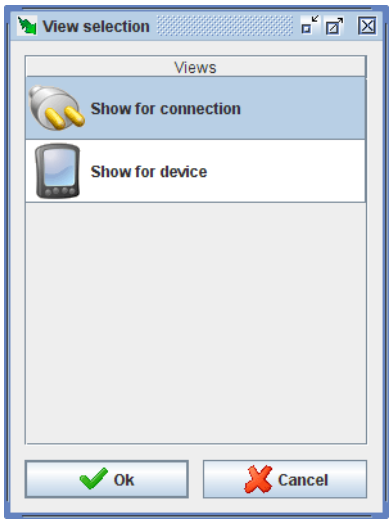
- **OK:** The equipment communicates properly.
- **Downloading of the device:** We are downloading data from the device at this time.
- **Error in connection:** The connection where the device can be found presents problems.
- **Device not started up:** Attempts were being made to establish communication with the equipment at this time for the first time. This process is necessary initially to ascertain the configuration of the equipment.
- **Failed communications:** Unable to establish communication with the equipment, response time is exceeded.
- **Incorrect version:** The equipment communicates correctly but it is a version which the programme does not support. Perhaps it is an old version.
- **Phase error:** The equipment communicates correctly but some phase connection is incorrect.
- **Channel error:** Unable to open the communication port. This action must be carried out to establish communication with the device.
- **Failed communications:** Some of the devices connected to this equipment do not communicate properly.
- **Camera transmitting images:** The engine is receiving images from the camera as the client application is requesting them.

- **Camera paused:** The engine is not receiving images from the camera because they are not necessary because they are not being requested by any client application.
- **Error on the memory card.** The SD Memory Card is invalid, write-protected or not present.

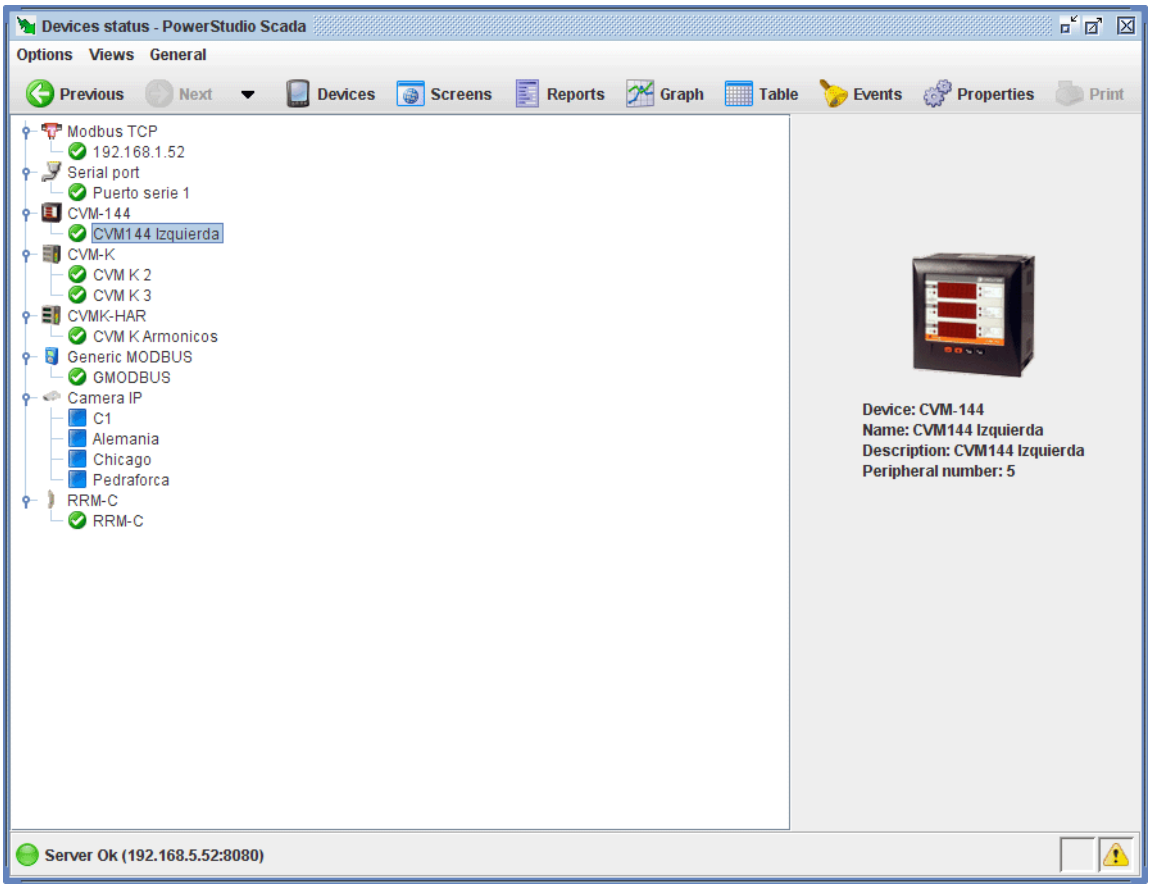
When selecting a device from this tree (any node), on the right panel, we can see the characteristics of it. Typically these features are a picture of themselves, the type of device, the name, description and device number.

This tree can be completely folded down quickly by clicking the right mouse button. It also can be folded down completely by clicking the middle mouse button, which is usually accessed by clicking the scroll wheel on it.

The device status tree can be organised in two ways, by connection or by type of device. To change the representation of the same, access the option of "*Properties*" from the toolbar or the equivalent option in the "*Options*" menu, after which you will get the following dialogue:



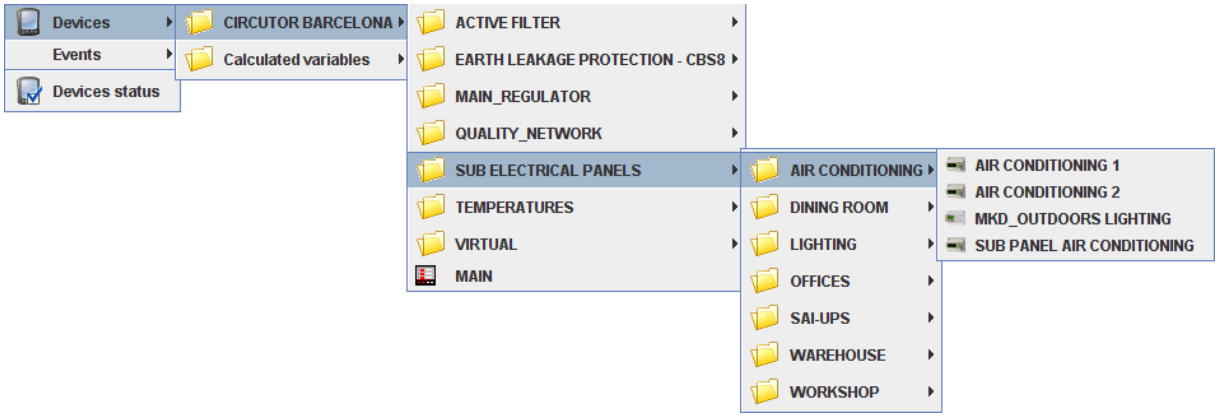
Selection of the device status tree organisation



Status of the devices organized by type of device

12.2.7 Displaying a device

The client application can visualize all devices in real time. Thus, each device provides one or more overviews that allow the status and values of the same in real time to be ascertained. This view can be accessed through the menu option "*Views*" and then "*Devices*" or directly from the button "*Devices*" in the toolbar. In both options the user should search through the device tree.



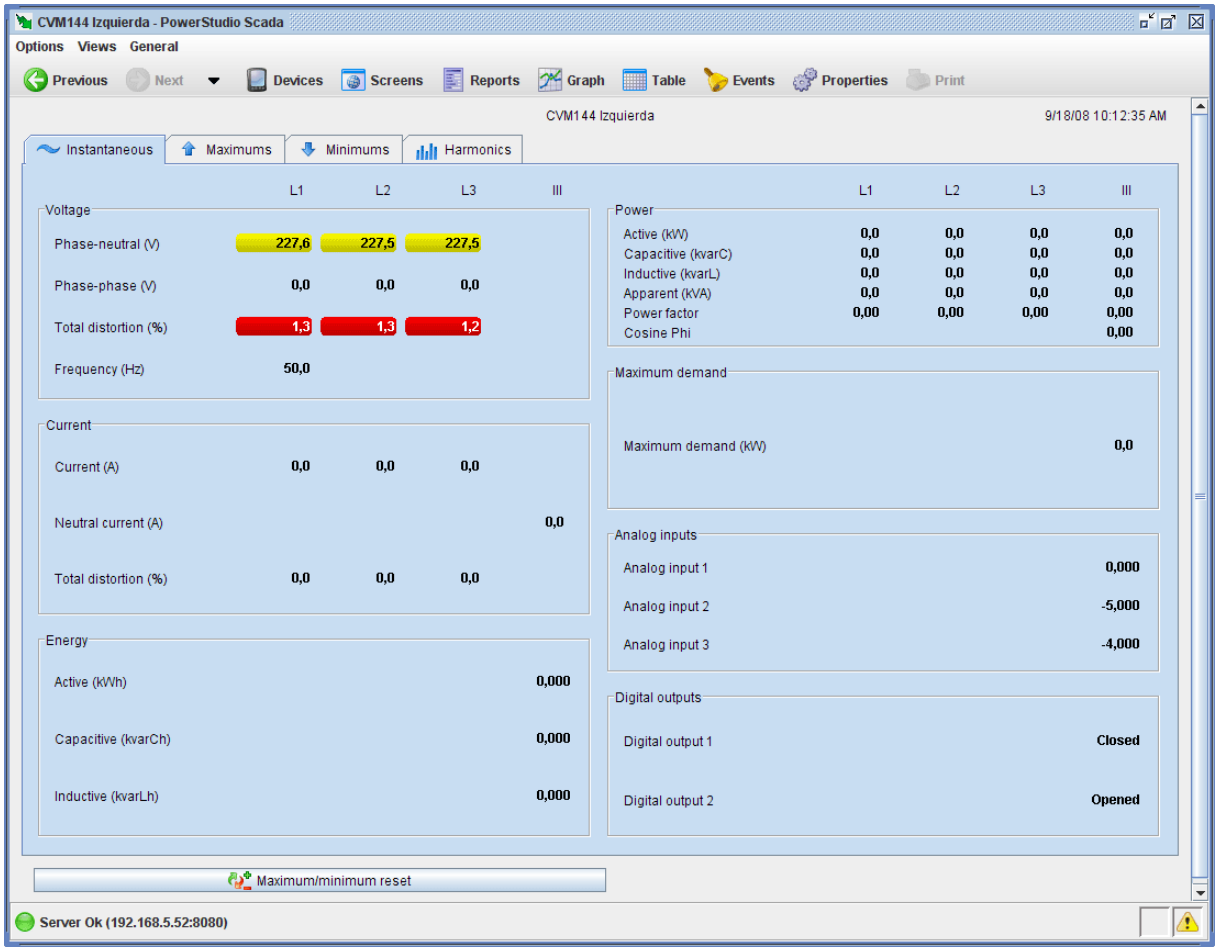
Device tree according to the organization defined by the user

You can also access the display screen of a particular device from a SCADA screen where a control device has been added.

A device display screen can have multiple aspects. Devices mainly define two types of screens, one analogue and one text (numerical). The analogue view presents most of the values in maximum, minimum and present bars, while the current view of the text presents them in the text form and organized in different ways, usually in tabs.

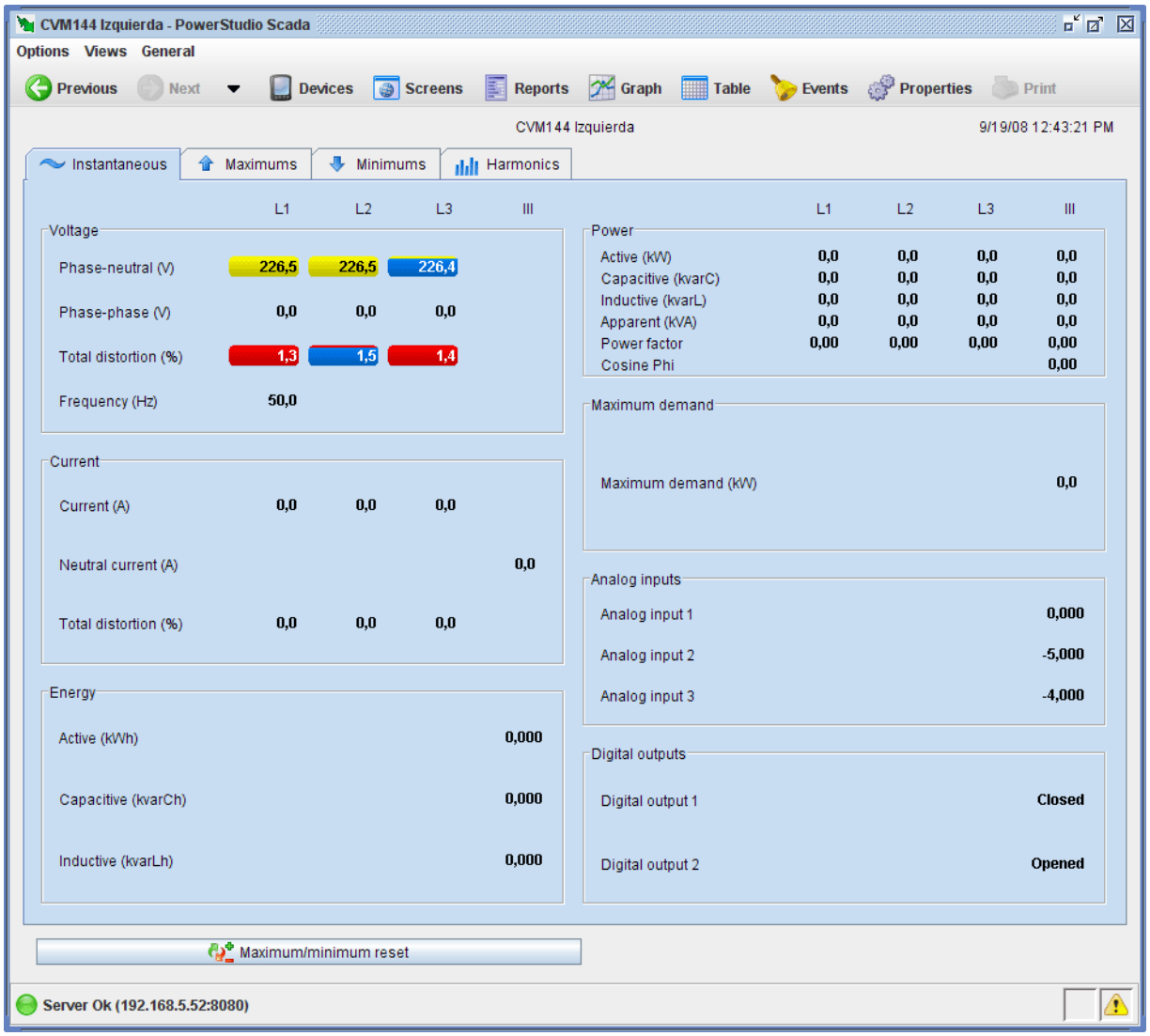
A common element on all the display screens is that there are numerical values for the variables which refresh in real time and can be selected to be used when making graphs or historical graphs (trends).

Another common element is that on most displays there is an upper bar specifying the status of the device, and the name and the date on which the values displayed were read.



Device display screen (text view)

As can be seen on the previous screen the values of the different variables are organized both in tabs, in graphs, tables, rows and / or columns for easier localisation. Similarly some of the variables selected can be seen, marked by white letters on a blue background. Another common element among the different overviews of the devices is that limits can be set on the variables values, so that they can be marked with one colour or another depending on the interval.



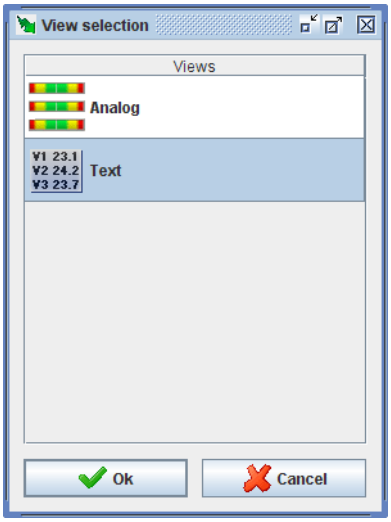
Screen display device with off-limits values

As can be seen in the previous screen there are values which exceed the limits defined. Similarly, how some variables are selected is also shown (blue background with white letters).

The analogue view provides approximately the same information but in a more graphic way, so that we can visualize the limits defined as a bar graph.

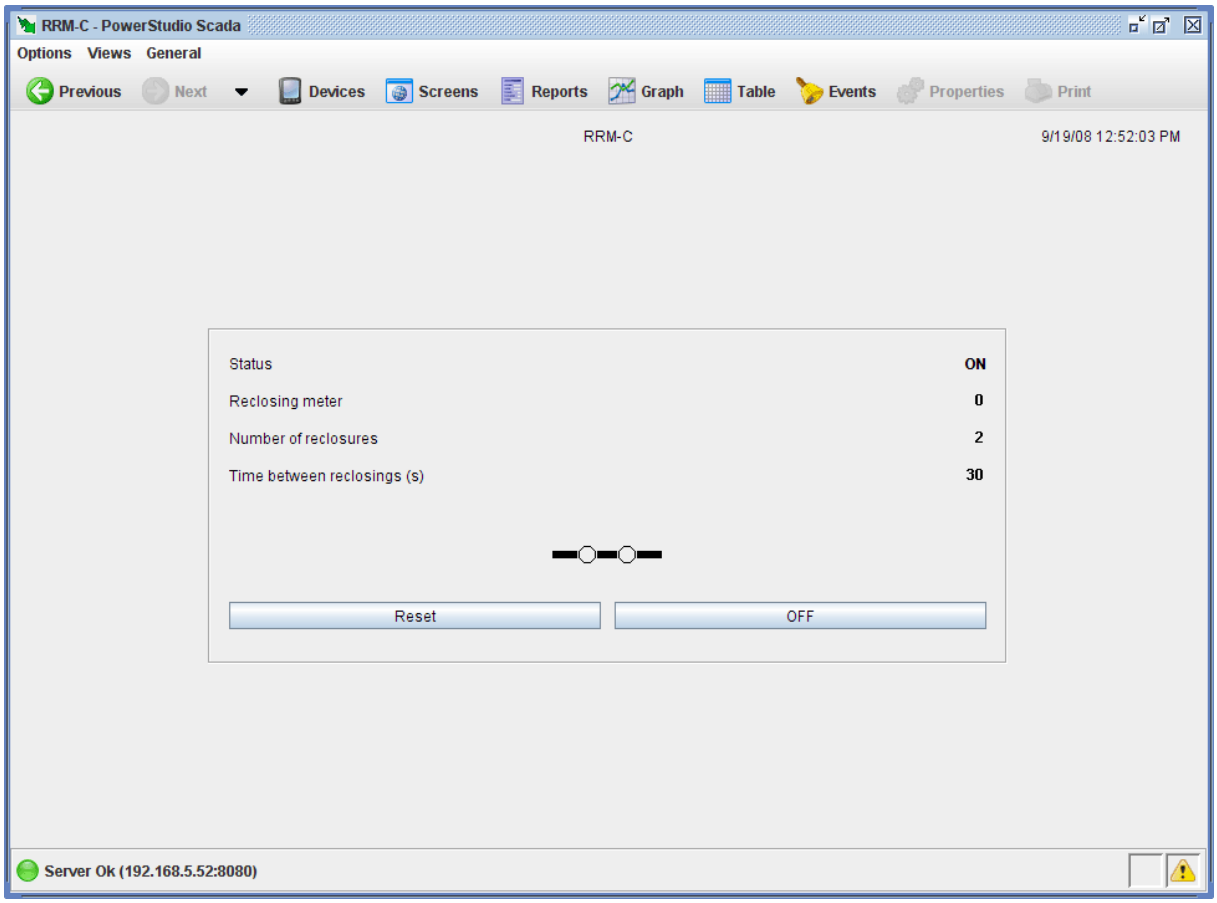
Device view. Analogue Representation

Devices providing more than one representation (typically two) can be exchanged with each other by selecting "*Properties*". This option can be accessed from the "*Options*" menu or from the button "*Properties*" from the toolbar. This option will be disabled for those devices that only have one possible view.

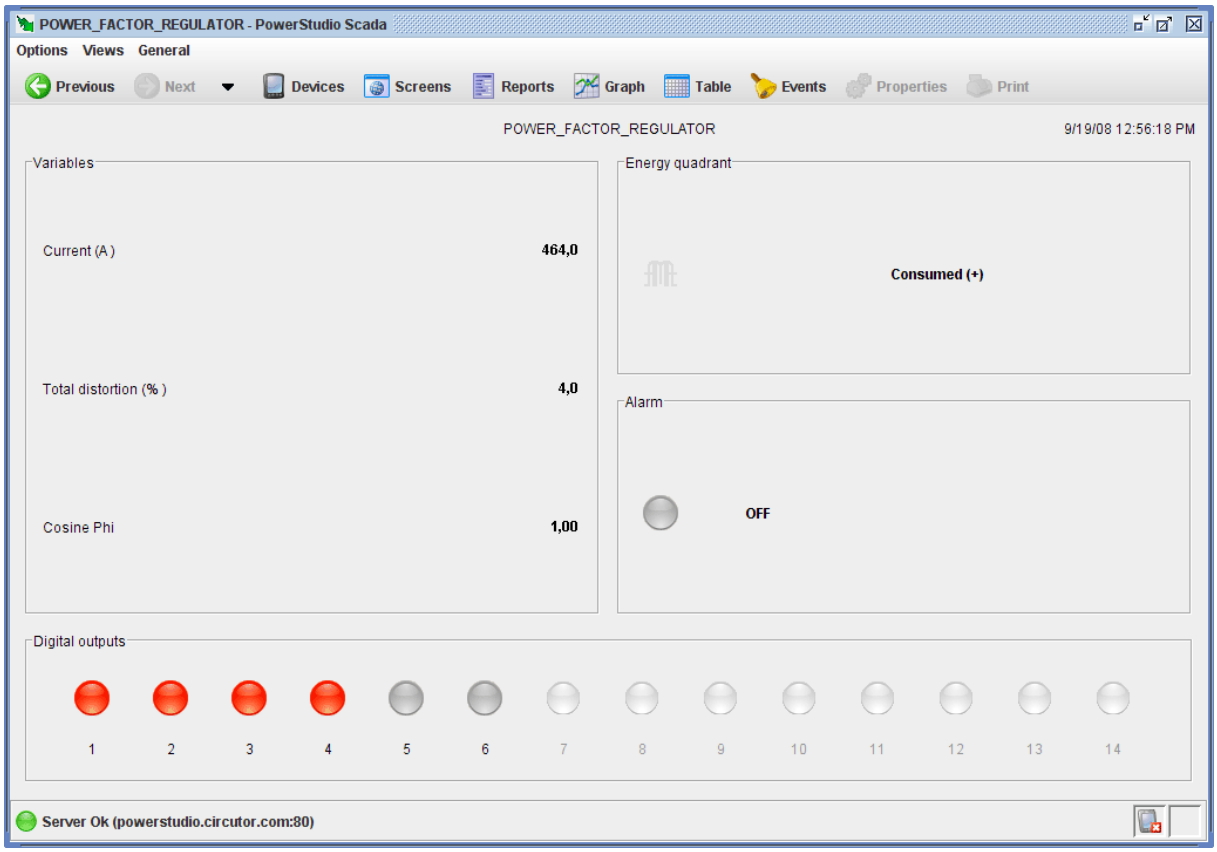


View selection of a device

The information about the devices does not only show the numerical values or bars organized into tabs, boxes, rows and / or columns, but can also appear in other forms, depending on the type of device in question. A typical way to represent the information would be graphically through descriptive images of the status of a variable or set of variables.

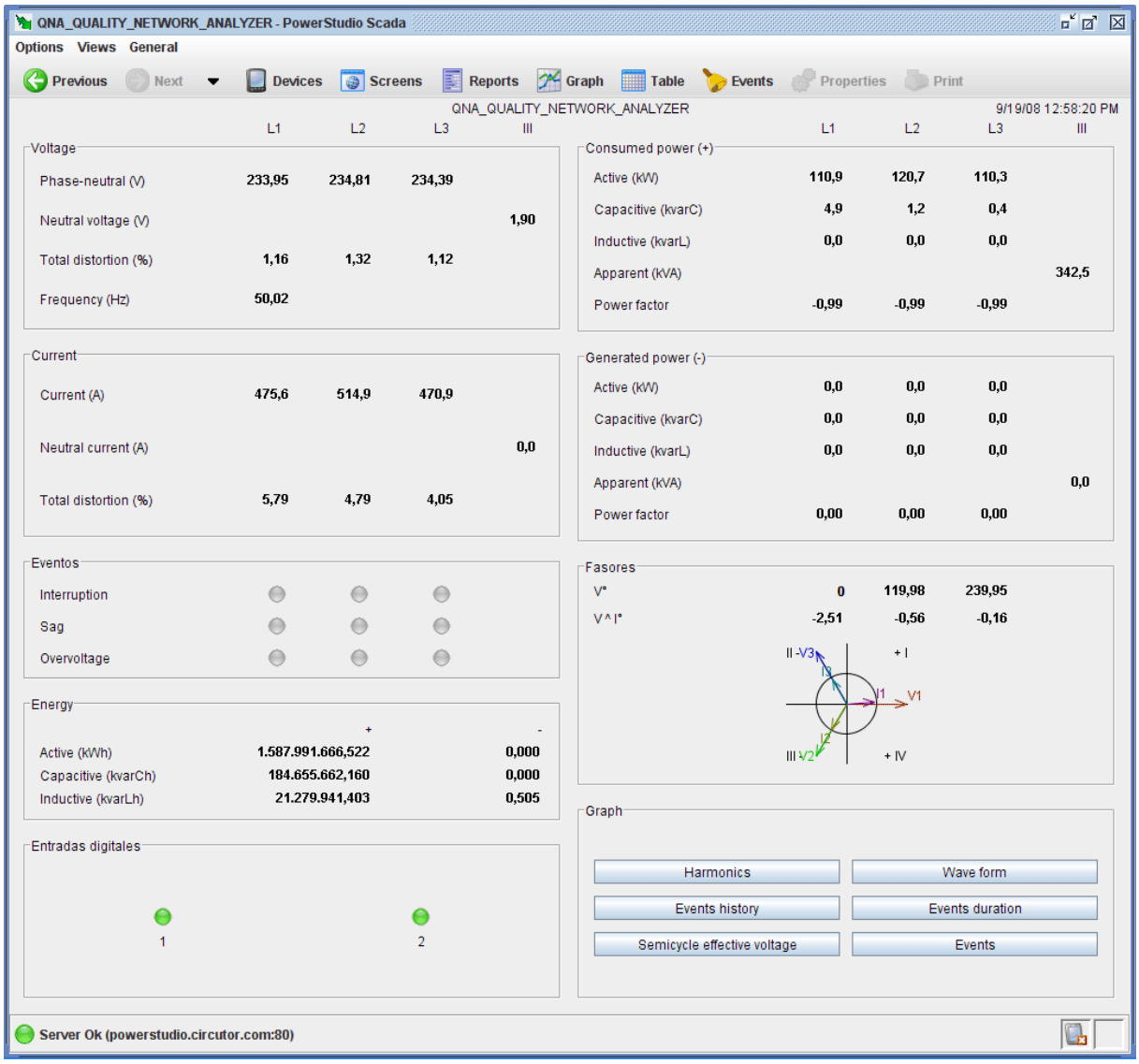


Displaying an RRM-C with an image representing the status of the relay



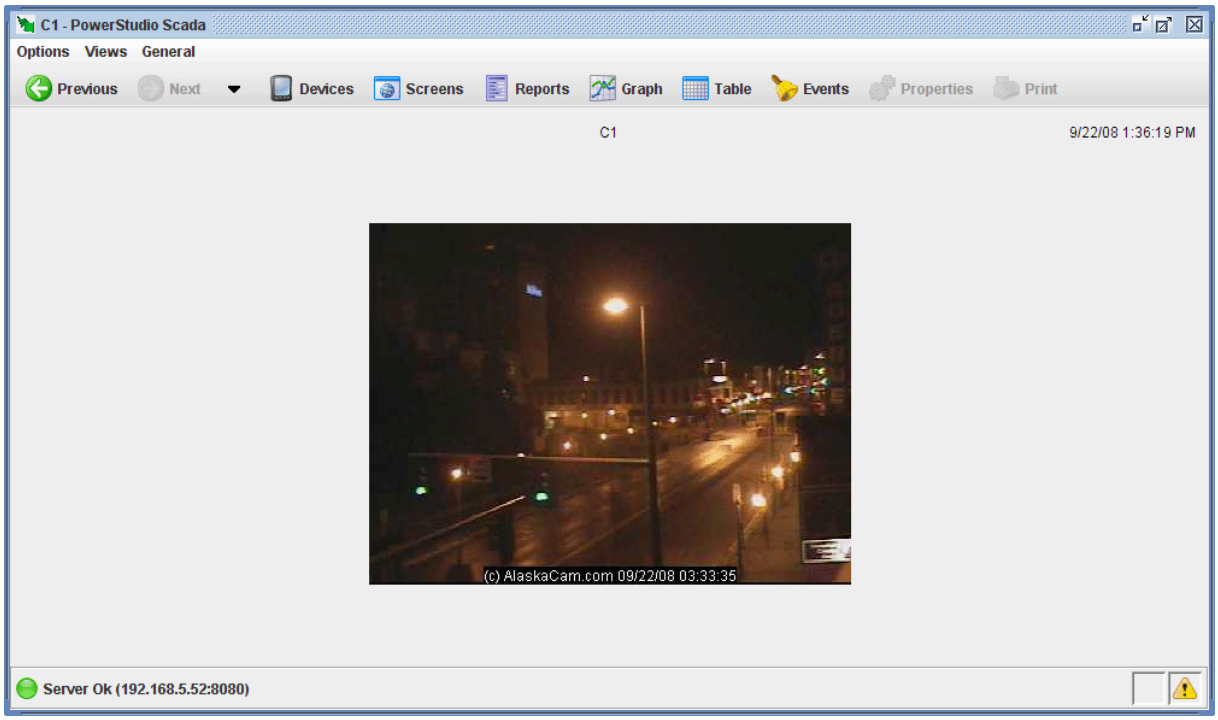
Displaying a C-14D with images representing digital output status, alarm status, etc.

Similarly other mores specific ways to represent the information can be found, such as the QNA phasor diagram.



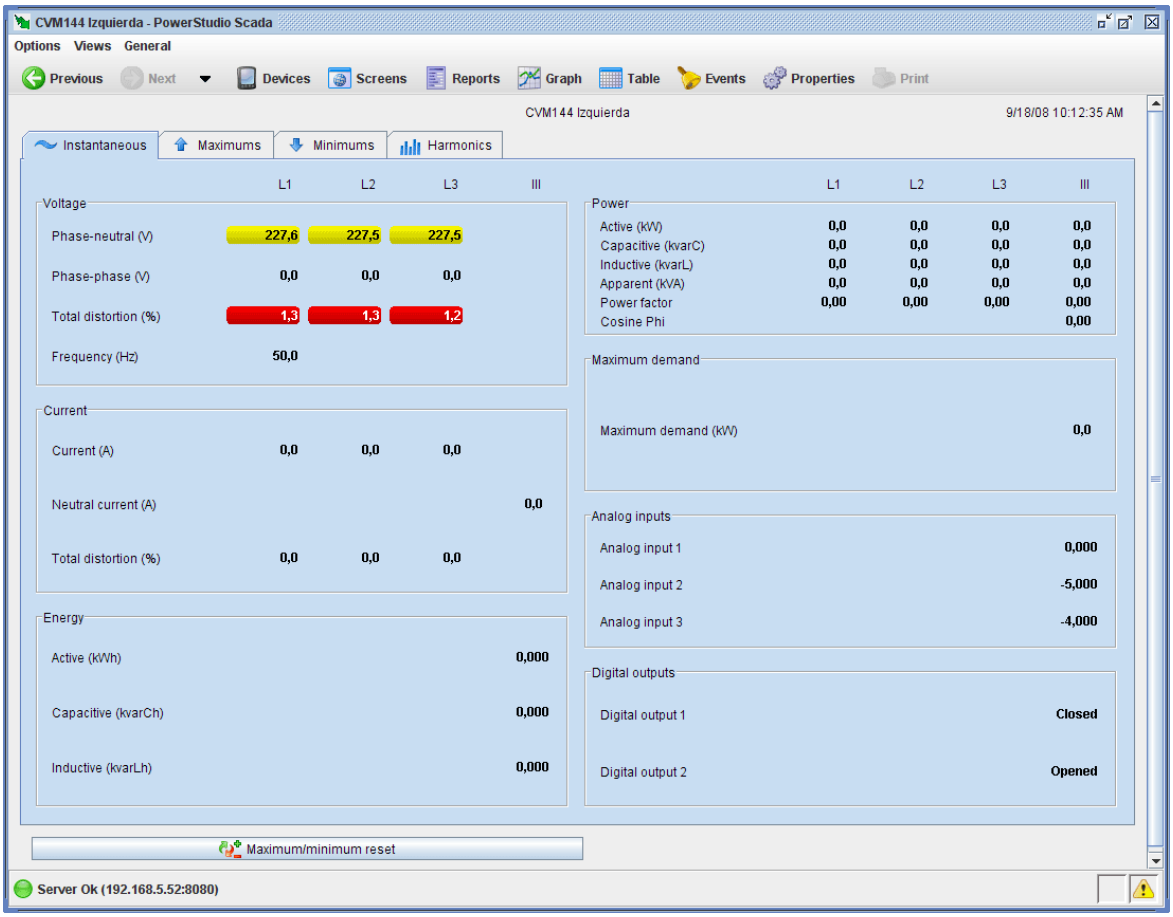
QNA Screen display with the phasor diagram

Another noteworthy device display screen is that which corresponds to the IP camera. This screen displays the camera image which is updating in real time (speed of updating depends as much on camera settings as the configuration for refreshing when adding this device, as well as the speed of the TCP / IP network)



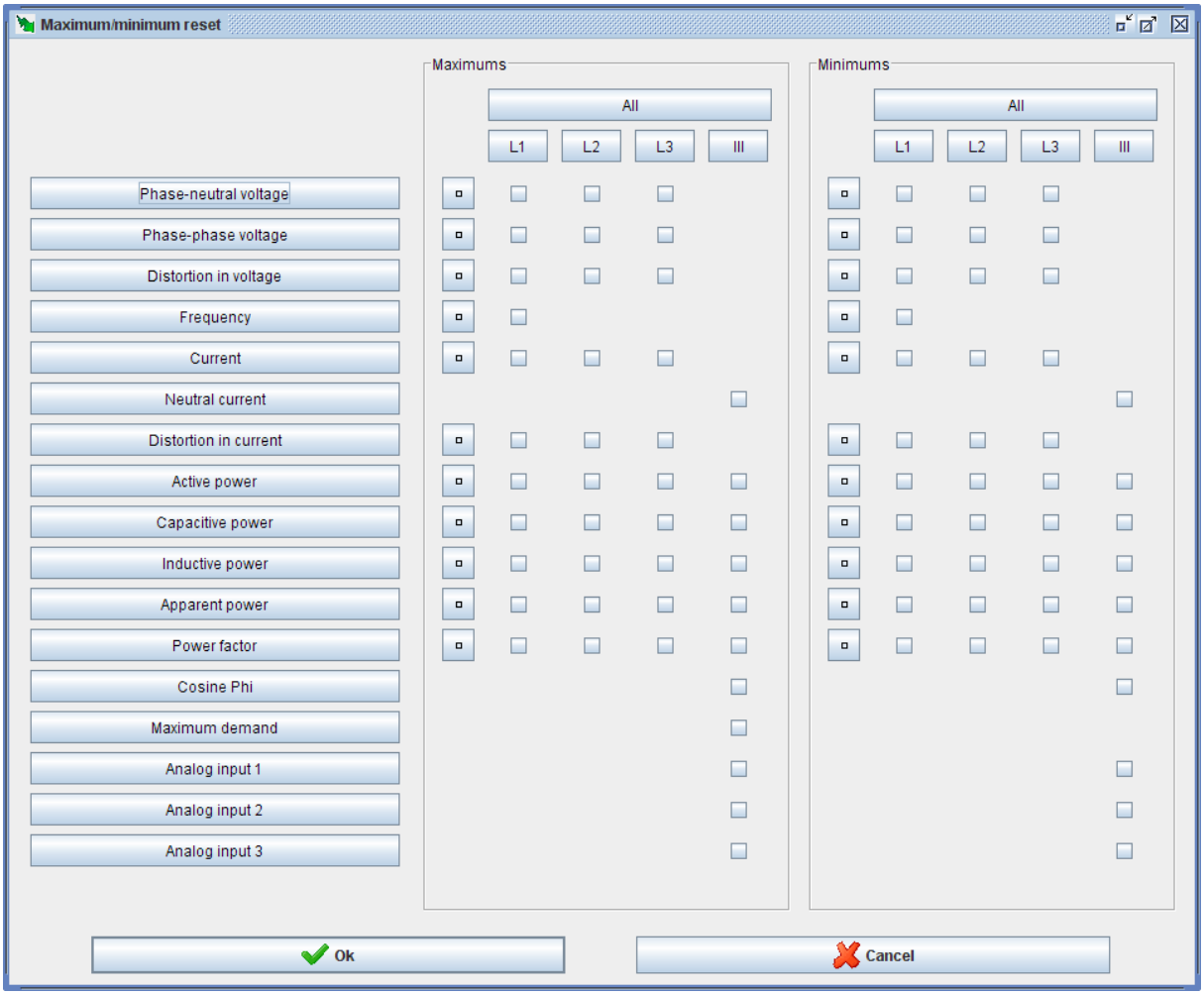
IP camera display screen

In addition to the information already mentioned, some devices allow interaction with the device itself or with the outside environment through the same screen display. An interaction provided by many of the display screens on the devices offers the possibility of resetting the maximums and minimums. This action is accessed via a button situated somewhere on the screen.



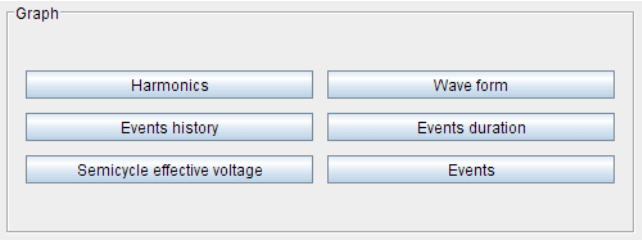
Display screen of the equipment with maximum / minimum reset button

Clicking on this button a window will appear where we can select exactly which values we want to restart. Each device provides a window for selecting different variables, depending on the type, the same type of device may even offer a separate window depending on how it is configured.



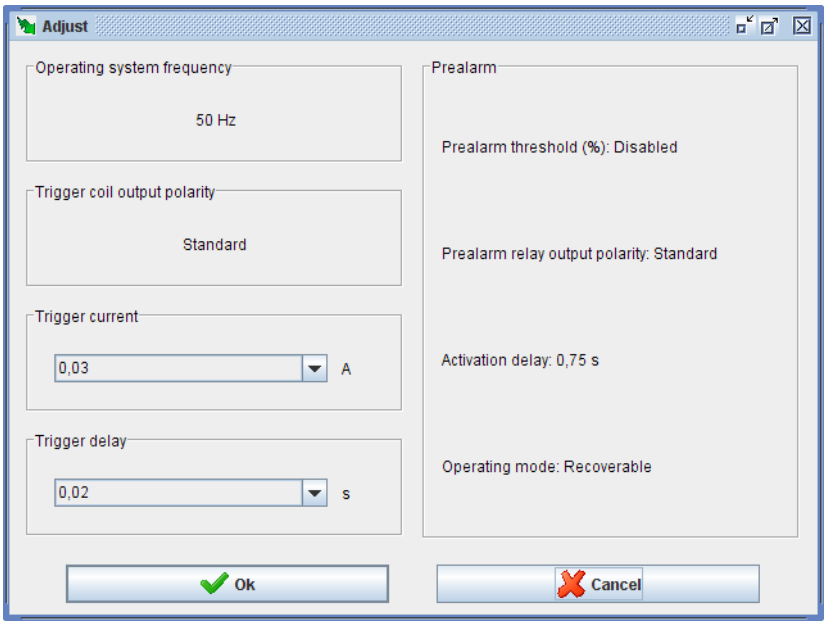
"Maximum / minimum reset window

Another typical interaction is by clicking on a button. This can include many different kinds, from acting on any digital output of the equipment or on any aspect of the configuration, to launching a special graph or viewing the table of historical events.



Buttons to launch special graphs on the QNA screen

There are devices that provide more elaborate interactions, enabling adjustments and more complex configurations by clicking on a button through a specific configuration window. For example, RGU-10 type devices allow current triggering values and trigger delay to be adjusted.



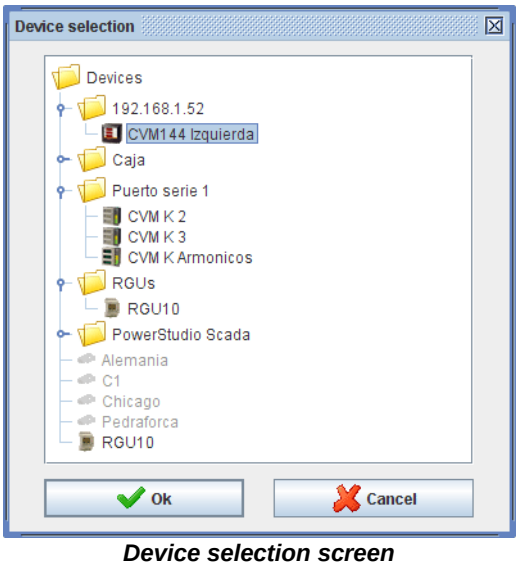
RGU-10 parameter adjustment window

From the monitoring view of a device it is faster to make a graph or a table, either through a direct button in the view itself (as in the case of QNA equipment) or directly by clicking on the corresponding buttons on the toolbar. This second option will be explained in the following section.

12.2.8 Making graphs

One of the most powerful tools of the client is the possibility of making graphs of the variables of the equipment (trends). This view can be accessed through the menu option "*Views*" and then "*Studio*" and finally "*Graph*" or directly from the "*Graph*" button on the toolbar. Graphs can be made from a predefined SCADA screen where the graph control has been added or as commented in the previous chapter, from the buttons defined for this purpose in some types of device monitoring views (e.g. on the monitoring view of a QNA).

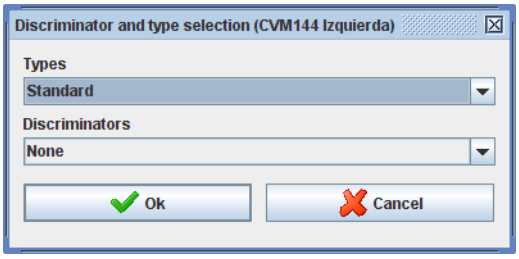
Typically, to make a graph the variables of the device which will be part of it need to be chosen. Thus, when accessing the "*Graph option*" from the main menu or from the toolbar, firstly a dialogue will appear that will allow us to select the device from which we want to choose the variables that will be part of the graph.



Device selection screen

Despite the fact that at first we can only choose variables from the same device to make the graph, later we can add variables from other devices (this will be explained later). If we access the "Graph" option while we are in monitoring the view of a device the client application will understand that we want to make a graph of what is being displayed and will skip back to the previous screen.

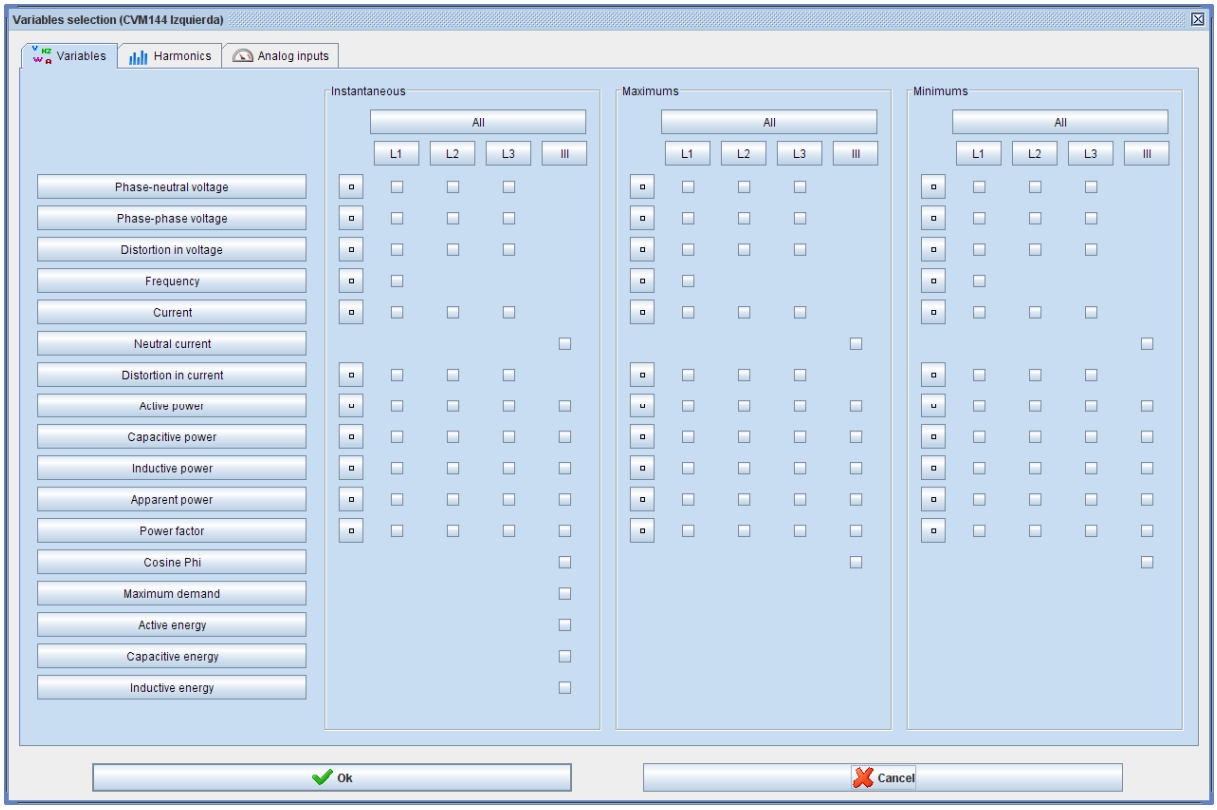
According to the device chosen, a screen will then appear to select the type of graph and the discriminator to be applied.



Selection Screen choice for the type of graph and the discriminator

Note only certain types of graphs can be discriminated, usually the standard type, if the graph type chosen cannot be discriminated the "Discriminator" option will be disabled. If a default discriminator has been defined for the equipment, although a different discriminator can be applied or modified or even no discriminator. It is also possible that the equipment does not allow more than one type of graph and that there are no discriminators defined or they are not applicable to this type of graph, thus this screen will not appear and will pass directly to the selection of variables of the device in question.

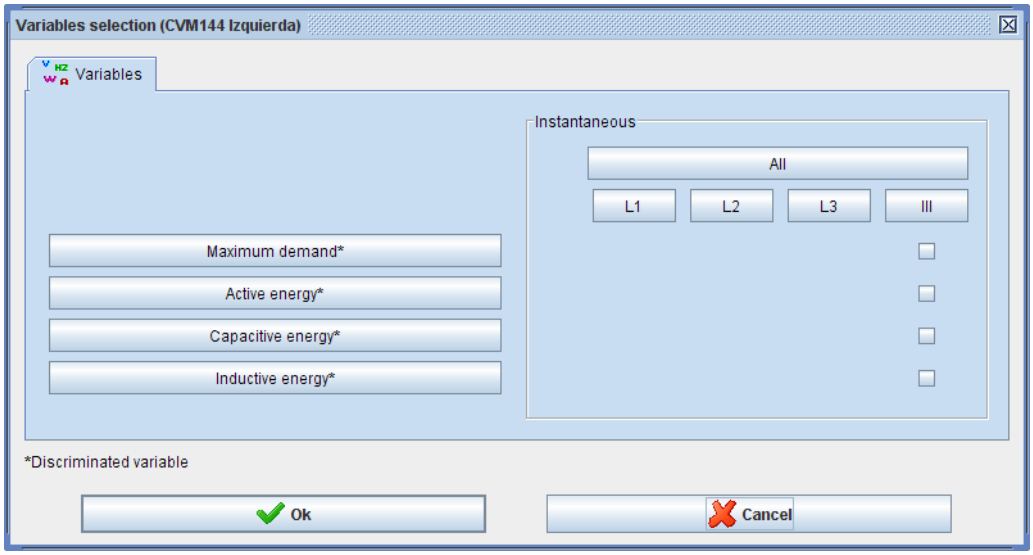
After selecting the type of figure and the discriminator, the selection screen of the variables will appear.



Selection of variables to make a standard graph without the CVM-144 discriminator

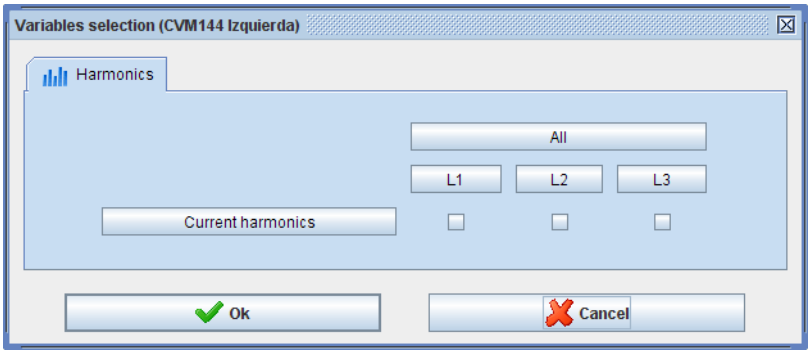
Here the variables we want to form part of the graph are chosen. This screen will depend on the device, the type of graph required and the discriminator we want to implement these variables.

For example, if a discriminator is chosen a screen similar to the following may be found:



Selection of discriminated standard variables

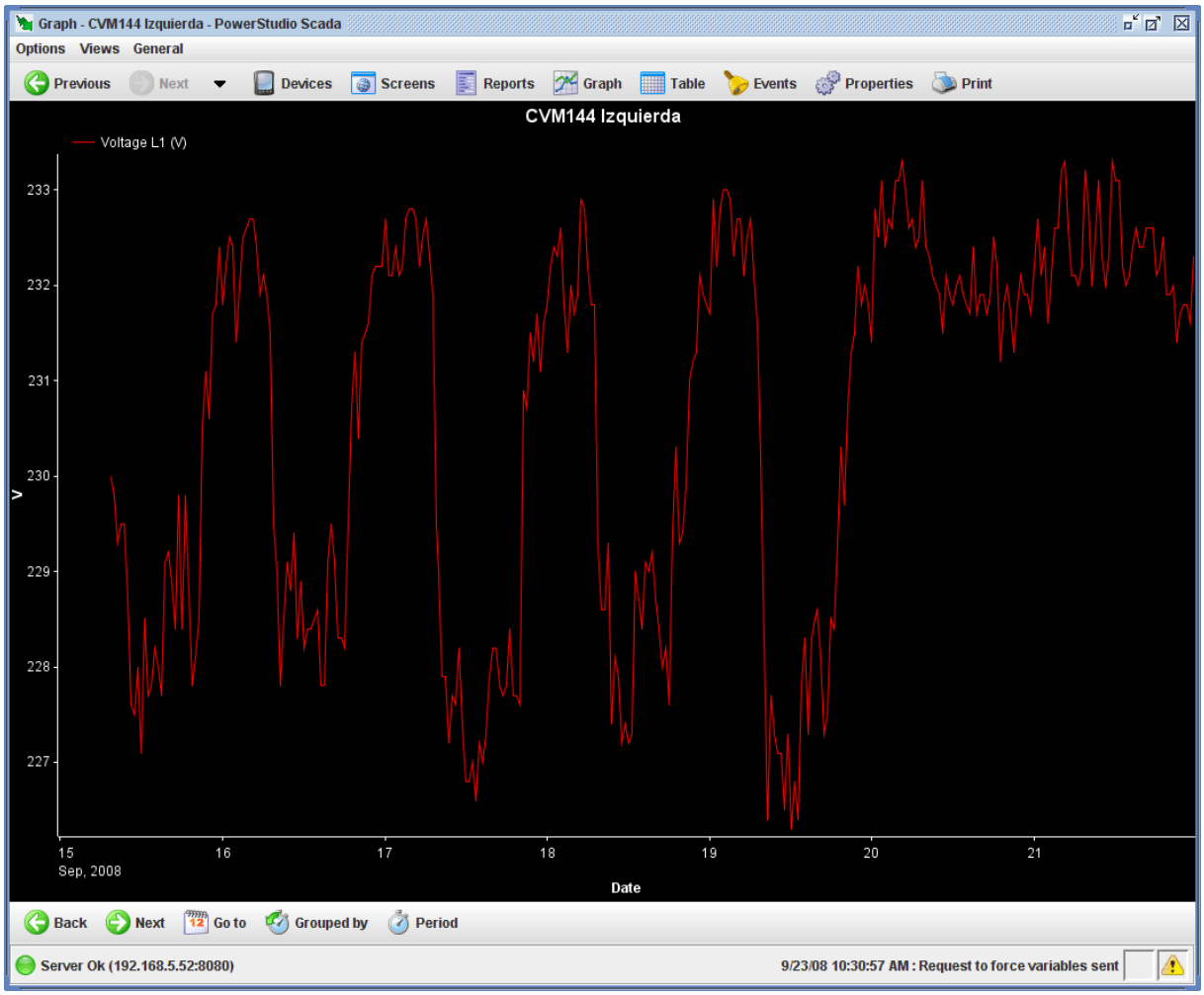
If we select a non-standard type of graph, for example, a harmonics graph, we find a screen for selecting variables like the following:



Harmonic variables selection screen

Finally, once the selection of variables we want to display has been carried out, the view of the graph with the representation of the variables in question will appear.

The system automatically chooses the representation period and the grouping of data, which can obviously be changed later. Later we shall explain what the two concepts mean and how they can be changed. It should be noted that the grouping chosen is a week and the period is typically 30 minutes. If the graph we are accessing comes from graph control on a SCADA screen, both the grouping and the period are determined in the control and need not be predetermined by default. However, as always, both properties can be modified in the graph view later. Similarly certain types of representations are chosen by default (line, bars, etc.), as well as a few colours and a distribution of the variables in axes and areas depending on the variables represented. All these characteristics can be modified later at will. A description of what they mean and how they are modified will be explained later.



Graph of a standard variable without discrimination.

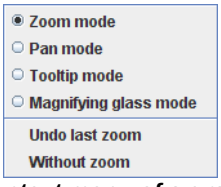
As can be seen a typical graph consists of a series of common characteristics:

- ***Title:*** Situated on the upper area, this is a text describing the graph we are viewing. Typically we find the name of the devices which form part of the variables we are viewing. They may contain several lines of text, so that they can be represented as subtitles.
- ***Areas of representation:*** These are areas where data can be viewed. Typically a graph usually consists of an area, as in the previous example, but there may be several, each under the following area. Each area contains some common characteristics:
    - ***Key:*** Provides general information about the variables that are represented in the area. This information is often the colour of the variable, the type of representation, the title of the graph, and in some cases, a value indicating some feature of the variable for the current representation (for example it is typical to see on energy variables the accumulated value of all the visible values).
    - ***Y-Axis:*** Provides information on the units of the variables that are represented in this axis and the range of values that are being displayed. At first the range is calculated so that they fit all the values of all the variables included in this axis. Typically an area has a y-axis, although this may be modified by the user as we shall see later.
    - ***X-axis:*** Typically this is the time axis and is located at the bottom of the representation area. Here the time interval being represented can be seen. Usually predefined time intervals are represented (day, month, etc.). But the user can choose the most suitable as can be seen later. Similarly, there are types of graph where this axis does not represent time, in this case the units represented and the range of values contained will be indicated.
    - ***Drawing area:*** Contains the actual figure representing the variables of the area in question. There is a drawing area for each area of representation.

- ***Toolbar:*** Contains a series of actions that can be performed on the graph. Depending on the type of graph it will contain more or fewer options. The typical actions are going to the previous interval, going to the next, going to a user-defined interval, grouping according to a predefined interval or changing the grouping period.

Any graph can always be found in the so-called "operating mode", which determines the behaviour of the drawing area and the use of the mouse on it. There are four possible modes of operation:

- ***Zoom mode:*** Lets enlargements be made on one portion of the graph. This mode is accessed through the F1 key or the corresponding option of the context menu of the graph.
- ***Pan Mode:*** Lets the present window be moved using the mouse, dragging and dropping. This mode is only available if a Zoom has been carried out before and it is accessed by the F1 key or the corresponding option of the graph context menu.
- ***Tooltip Mode:*** Lets us see the values of the variables in the position of the mouse cursor. This mode is accessed through the F3 key or the option corresponding to the context menu.
- ***Magnifying glass Mode:*** Enables the area under the mouse cursor in a separate window to be amplified. This mode is accessed through the F4 key or the option corresponding to the context menu.



Context menu of a graph

12.2.8.1 Zoom mode

The zoom mode allows us to make extensions on a portion of the drawing area with the mouse. When we are in this mode the mouse cursor looks like a magnifying glass.

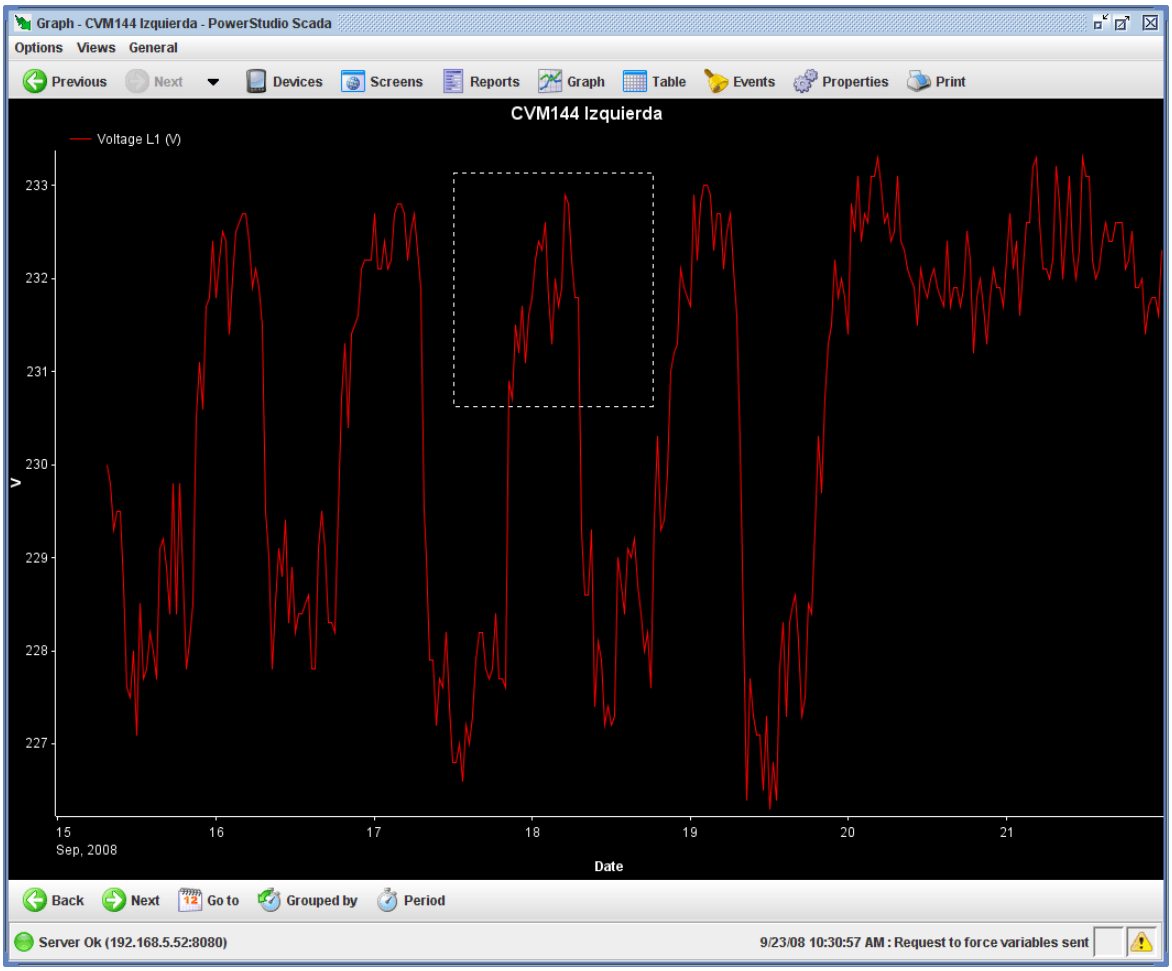
Appearance of the cursor in the zoom mode (when it is possible to start zooming and when not)

As can be seen the cursor will tell us whether we are on an area where it is possible to start a graph expansion or not (typically because we are outside of the drawing). To start an enlargement click on the left mouse button on the drawing point we want to be one of the corners of the new viewing window and, without releasing the button, move the mouse to the point of drawing we want to be the opposite corner of that window.

It is interesting to see that while moving the mouse discontinuous lines indicating what will be the new viewing window will appear if we release the button. Equally the cursor informs us whether the window we are selecting is not valid as a new viewing window by changing the appearance of the mouse cursor.

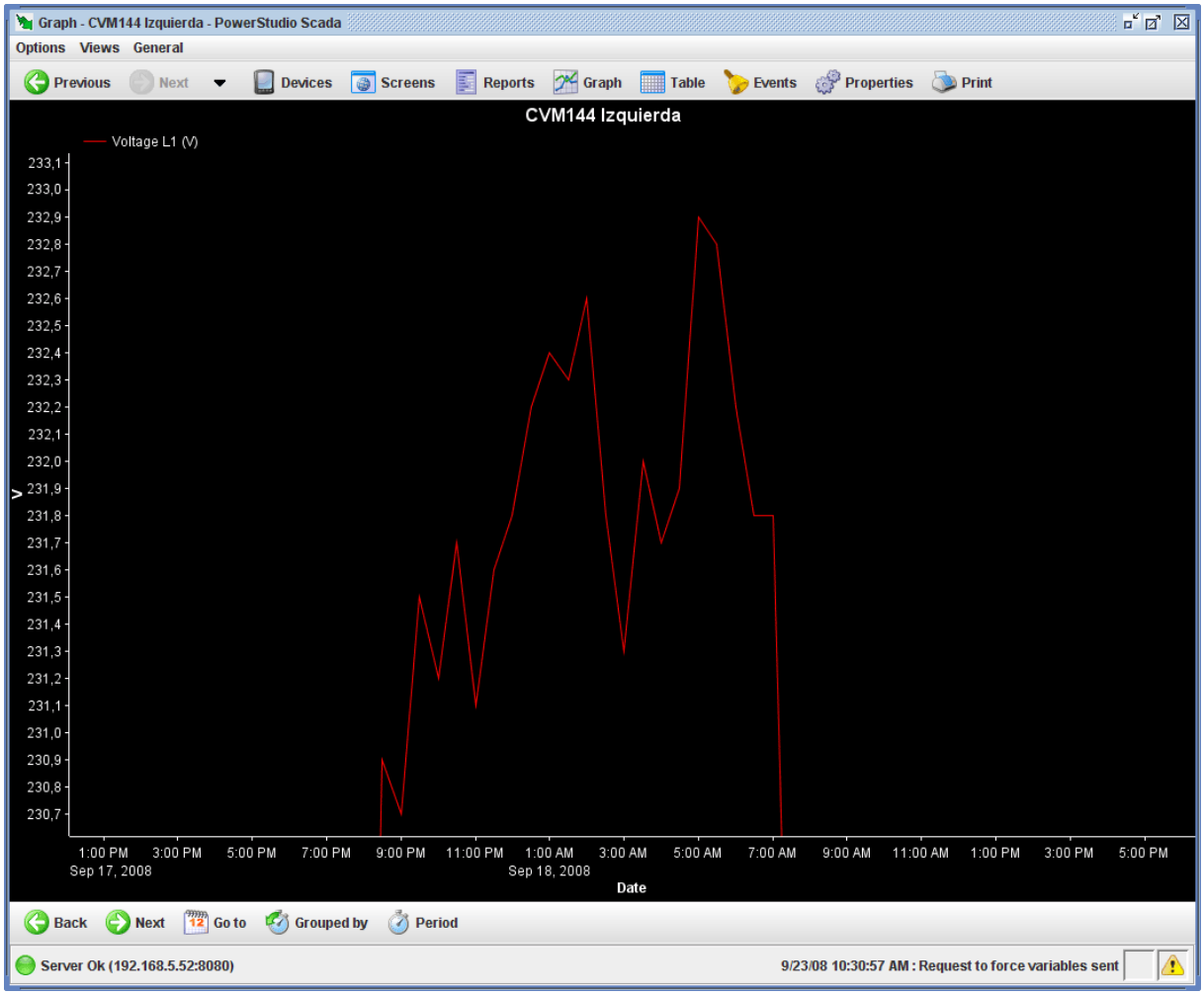
The new viewing window is invalid or is not permitted

This may be because it is too small, narrow or wide, both in window units (pixels) and variable units, both in the X axis and the Y. For example, if we have a variable with a period of one hour we will not be allowed to make an extension of an area of the drawing of less than an hour on the X axis.



Making an extension of an area of the drawing in the Zoom mode

By releasing the left mouse button we accept the discontinuous window as a new display window. The action will be automatically executed and we will be able to see the enlarged area that we have chosen.



Graph with the enlargement of a specific area

The process can be repeated as many times as desired, provided that the system permits it. Enlarging enables the "Pan mode"; that we shall see later, as well as the options of "*Remove the last zoom*" and *"Without zoom*" in the context menu.

The option "*Remove the last zoom*" allows us to return to the previous enlargement, namely the display from where the present enlargement took place while the option of "*Without zoom*" allows all enlargements to be done away with in one go.

Enlarging a chart with several display areas is worth commenting on. If we make an enlargement on a graph of this type it can be seen that areas marked off with dashed lines in the display area can be observed, but they also appear in other areas too, selecting the same interval X (usually time).

Zooming in with a graph with several areas of representation selected in the first zone

This behaviour is defined by default, giving priority to conserving the same X-axis in all areas (it is usually useful to compare values with the same dates or intervals, and therefore does not apply if the X- axes are different and is only included in the enlargement of those areas with similar X-axes , although they are not consecutive). Note that when the enlargement is carried out in more than one area all the new selections are horizontal.

The behaviour of "*Zoom mode*" can be changed by varying the idea previously discussed using the "Control" or "Shift" keys while selecting the new display window.

The "Control" key forces the selection to include only the area where the enlargement is being made; therefore if the graph consists of a single area this modifier has no effect. If the enlargement is being made between two different areas (one corner of the new window is in one area and the other in a different area). This forces only the areas between the two to be included.

For example, if we start the enlargement in the first area and finish in the second only these two areas and not the third will be enlarged. A curious effect caused by this mode is that areas with different X-axes can appear. In addition, this behaviour does not take into account whether the X-axes are equal or not, always forcing the enlargement regardless of this information, thus allowing the expansion of two zones with different X-axes something that would be impossible with the default behaviour.

Graph with areas with different X axes (the first zone has an X-axis different from the other two)

The “Shift" key forces the enlargement to only affect the X-axis, even in the area where the expansion is taking place, but keeps the enlargement of all the areas maintaining the X-axis as in the default behaviour. Note that if a graph consists of a single area this change in behaviour causes the non-selection of the new viewing window not to affect the Y-axis

The combination of behaviours, Clicking the "*Control*" key and the "Shift" key at the same time will enable us to enlarge graphs with more than one representation area, a single area depending on their X-axis. The user can freely combine the various behaviours in successive enlargements.

12.2.8.2 Pan mode

The "Pan mode" is available when there is an enlargement carried out and it enables us to move the viewing window using the drag and drop technique. When we are in this mode the cursor looks like a hand.

Appearance of the cursor in the pan mode (when it is possible to start the pan and when not)

As you can see the cursor will tell us whether we are on an area where it is possible to initiate the movement of the viewing window or not (typically as we are out of the drawing zone). To start a movement click on the left mouse button on the point of the drawing you want to use as an anchor and, without releasing the button, drag the mouse until we have moved the window to the desired location. Note that the window moves in real time with the mouse movement.

It is interesting to see that once the anchor is positioned the mouse cursor will change to tell us that we are able to move the viewing window.

Cursor indicating that we are able to move the viewing window

The movement is limited by margins of the viewing window before making the first enlargement, therefore, if we are viewing a week of data we cannot move to the previous or following week using the pan option or on top of the upper margin of the Y-axis or below the lower of the axis itself.

When we have a graph with more than one display area the pan mode establishes, by default, behaviour through which all areas with the same X-axis as the area where the anchor is established must move. This behaviour can be changed by using the "*Control*", key if we keep the key held down while we move the window we indicate to the programme that only the window on which the anchor is established must move. This will cause the X-axes to be no longer matched.

Graph with all the display areas with different X-axis

12.2.8.3 Tooltip mode

The "Tooltip mode" allows us to see the values of the variables located closest to the cursor with respect to the X-axis. These values are updated instantly as you move the mouse cursor. When we are in this mode the cursor looks like a hand.

Cursor indicating that we are in the Tooltip mode

The mode behaves in such a way as to show the values closest to the mouse position with respect to the X-axis of all the areas that share the same X-axis.

Graph in Tooltip mode

As you can see, for each area of representation with the same X-axis a window is shown with the value of the X-axis (typically the date) and information on the variables that are represented in this X position (typically the variable name, its value and its units).

You can change the behaviour of this mode by clicking the "*Control*" key, so as to show only the information window of the area on which the mouse cursor can be found at any time.

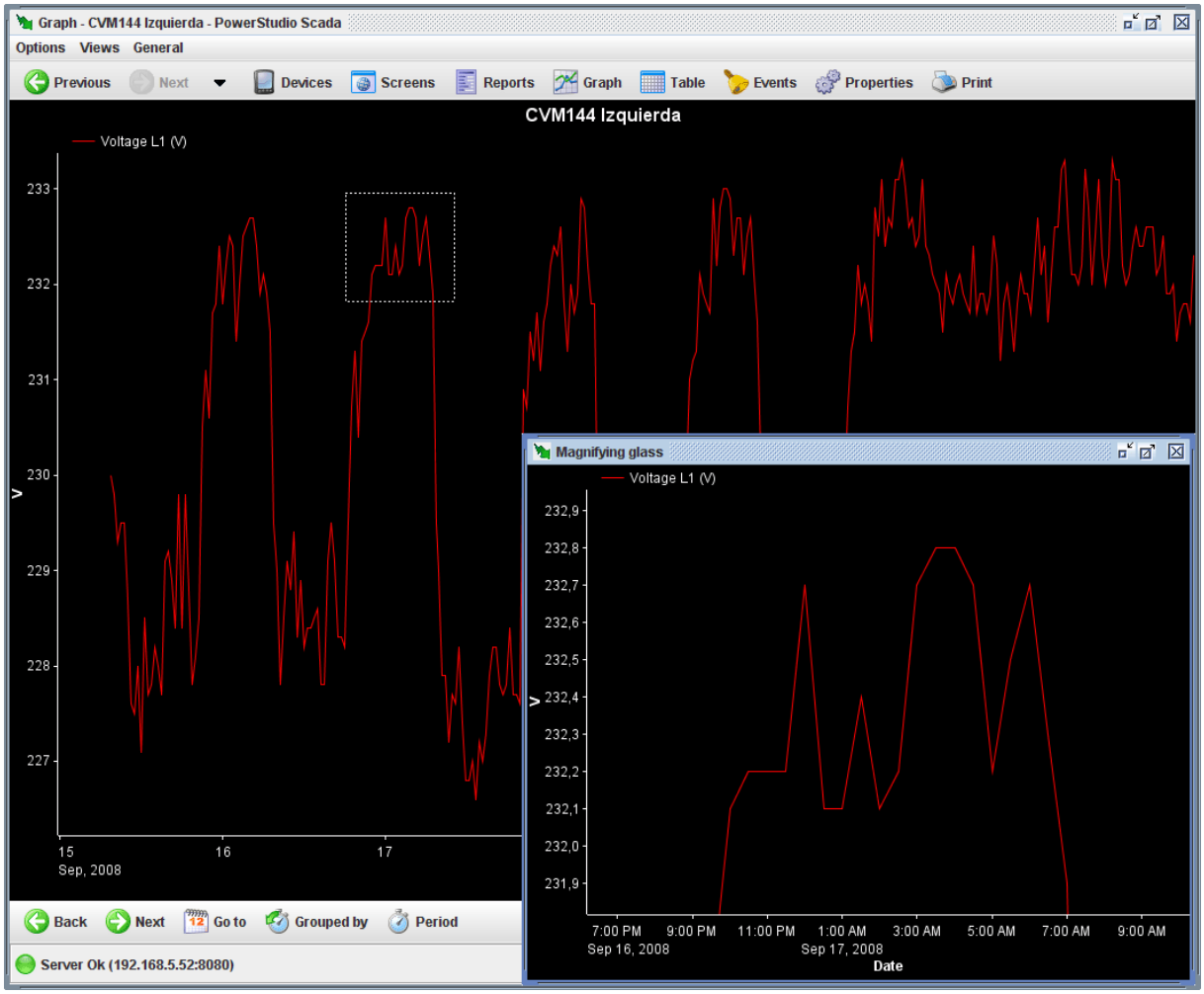
In graphs with a high density of values the case may arise that several different values with different X coordinates of a variable fall into the same position of the mouse. In this case there will be no values accessible through the mouse cursor movement. To access all the values without omitting any we can move the value display window using the cursor keys (left or right), these keys allow us to move to the value immediately before or immediately after the current although this is drawn in the same position of the screen.

Some types of graphs can give the situation that on the same X-coordinate there is more than one value of the same variable, this does not happen if the X-axis is time, but it can happen in other cases, as for example in an event duration graph, which will be seen later. In these cases the maximum and minimum value of each variable in that X-coordinate will be shown.

12.2.8.4 Magnifying glass mode

The "Magnifying glass mode" allows us to see an expansion in a separate window for the area around the position of the mouse. The enlargement window is updated instantly as you move the mouse cursor, always showing the area around it.

If we enter on the magnifying glass mode and the cursor remains on the representation area an enlargement window will automatically appear and a dotted box will appear in the drawing area indicating that the area is enlarging, represented by the mouse cursor, and we can move around as we wish, automatically displaying the enlargement in the superimposed window.



Zoom mode graph with an extended zone

If we leave the representation area the enlargement window will disappear, and on returning there, the mouse will have the following aspect:

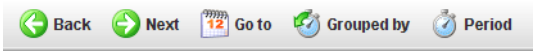
Mouse cursor indicating that we are in the Magnifying mode in the area enabled for this

This will tell us that we are in magnifying glass area and that we can enable the enlargement area when we so desire (clicking the left mouse button). Logically, the extension window can be re-sized and positioned as we wish like any other window.

Another possibility is to vary the size of the square area around the mouse cursor we want to expand. This can be done through the mouse wheel or, if the mouse does not have this feature, through the “+” keys "(greater square area) and" - "(smaller square area).

12.2.8.5 Toolbar

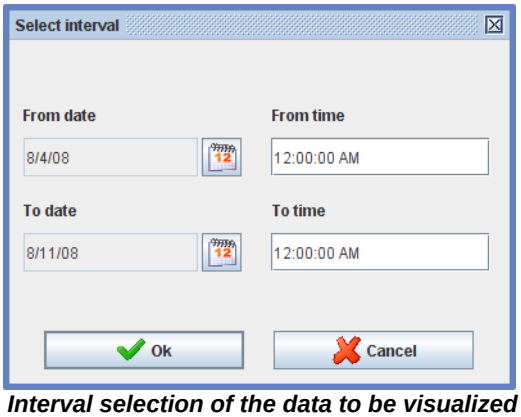
The graphs always have a toolbar at the bottom that allows a series of actions related to the data to be shown.



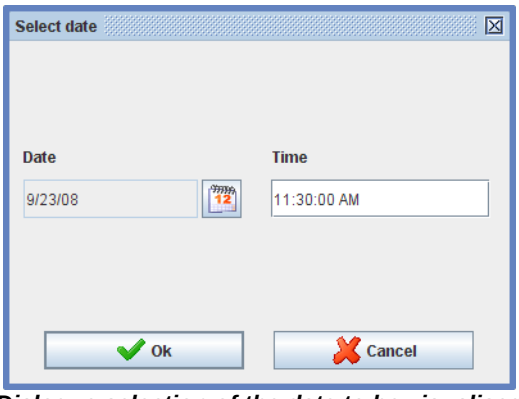
Toolbar of a typical graph

The typical options available in the toolbar are:

- ***Previous:*** Allows access to the previous interval of data. Typically the range of previous data is the function of the grouping of data and, if we group data by days on going to the previous interval we will see the data of the previous day being displayed. There are types of graph where grouping does not make sense since they are viewing values of a specific date (for example in QNA harmonics graphs), in this case by clicking on this option we will see the data corresponding to the date immediately after that containing data.
- ***Next:*** Allows access to the next interval of data. Typically the interval of data following this is based on the grouping of data and, if we grouped data by weeks on going to the following interval we will see the data from the following week being displayed. There are types of graph where grouping does not make sense since they are viewing values of a specific date (for example in QNA harmonics graphs), in this case by clicking on this option we will see the data corresponding to the date immediately after that containing data.
- ***Go to:*** Lets us look at data within a time interval defined by the user. There are graphs where it makes no sense to specify an interval and what it permits is to indicate the exact date that we want to see (graphic harmonics in QNA).

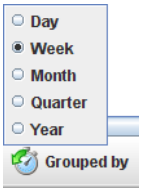


Interval selection of the data to be visualized



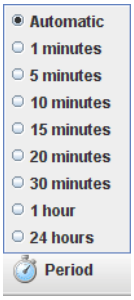
Dialogue selection of the date to be visualised

- ***Grouped by:*** Allows us to change the grouping of data. The grouping is just the interval of data we want to visualize. Typically there are five predefined groupings: day, week, month, quarter and year.



Selection Menu "Grouped by"

- ***Period:*** Enables the period in which we want to see the data to be specified. Each device can be configured to store data every so long, typically in periods of 10 or 15 minutes. Through this option it is possible to indicate that we want to see data with a different period, which must always be higher than that defined by the device. Note that this does not change the configuration of the device, which will continue saving with the period configured from the engine / editor, but will group the data, to a certain extent, to simulate the fact that the device was programmed for that period. Note that there is an "Automatic" option; this option indicates to the program to choose the period that best suits the selected grouping.



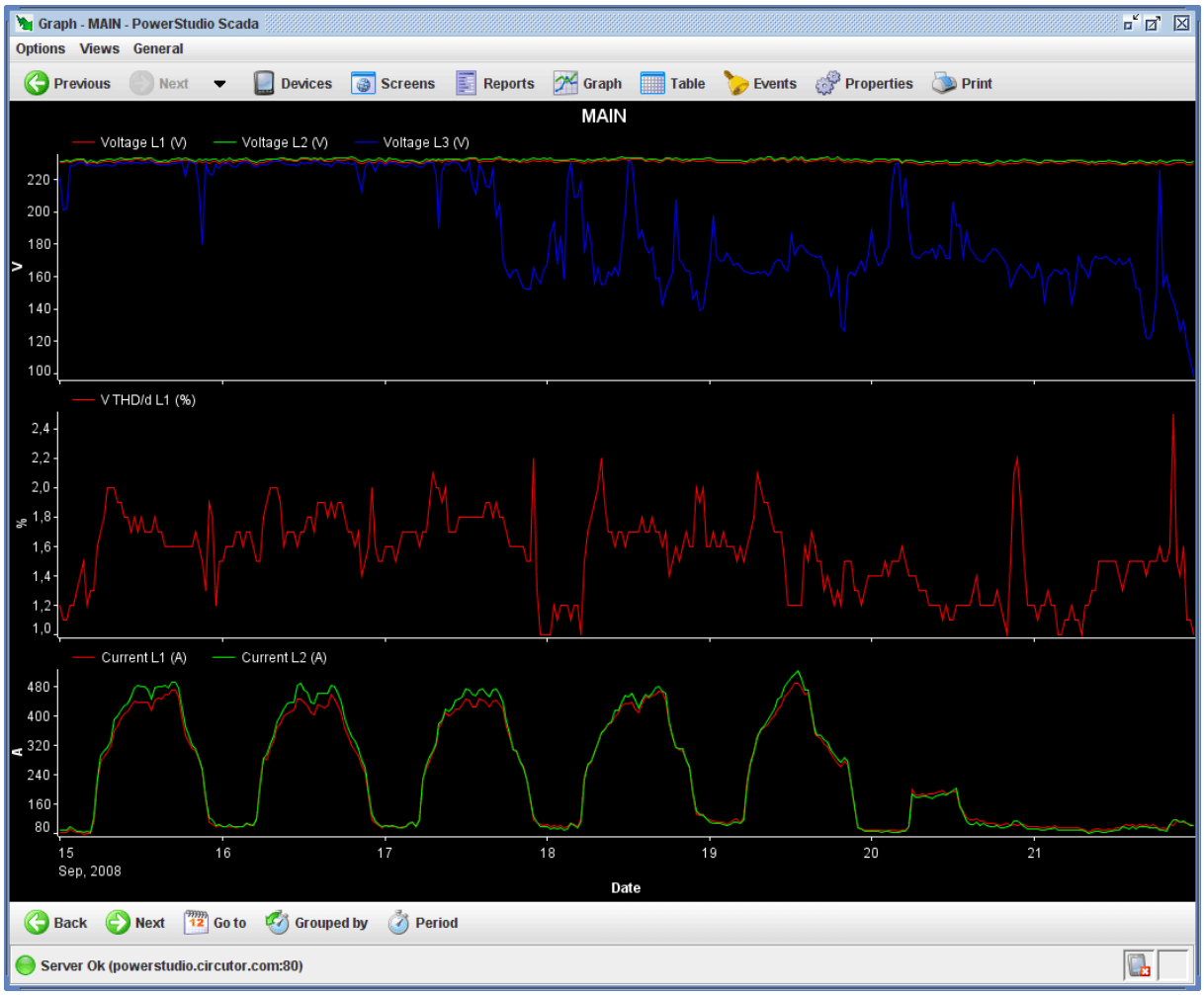
Period selection menu

Note that there are special graphs where the last two options (“Grouped by" and "Period") are meaningless and therefore not available.

12.2.8.6 Graph properties

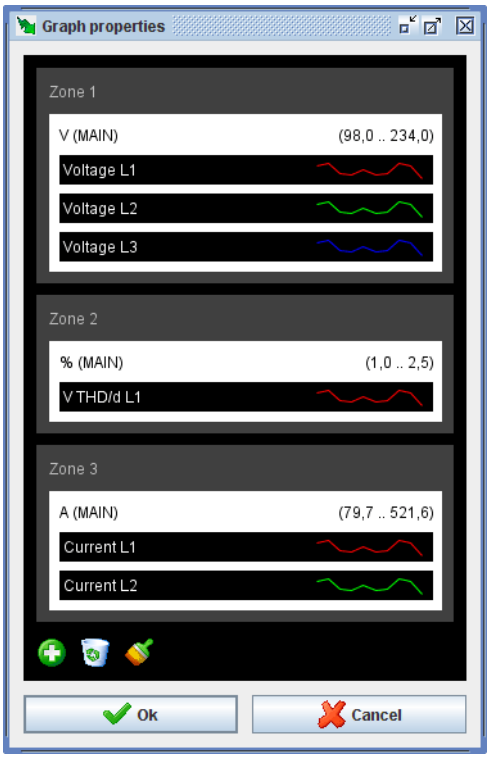
It is possible to configure many more aspects of the representation using the “properties” option of the graph. This option can be accessed through the menu “*Options*”, submenu "*Properties*" or directly through the button "*Properties*" on the main toolbar.

Suppose we have made a graph of the variables of the three phases of the voltage and the voltage distortion in phase one and the phase one and two current of the QNA measuring equipment. The client will provide us with a view of the graph with default configuration, namely a graph grouped as a week, set at the current week, with 30-minute periods, with three areas of representation (one where all three voltages are placed, another where the distortion is placed and a final one where the two currents are placed) etc.



Graph with variables from a QNA

To change the graph properties we access the option previously indicated and a window similar to the following will appear:

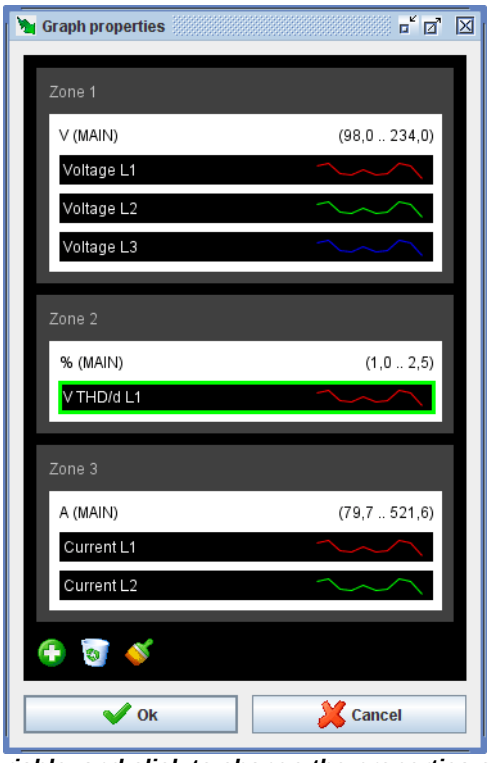


Properties window of a graph

This window will allow us to make the following changes on the graph:

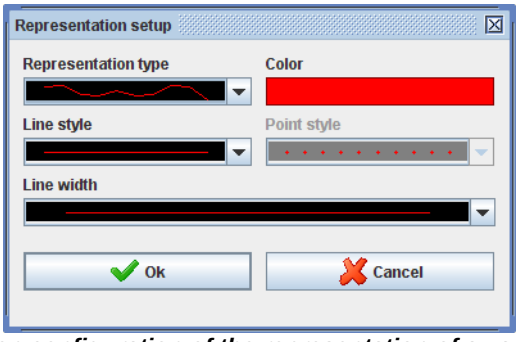
- Modify the representation of each variable (lines, bars and points)
- Change the colour of each variable.
- Modify the y-axis margins.
- Remove areas, axes and variables.
- Add areas, axes and variable.
- Change the distribution of the areas, axes and variables.

As can be seen in the previous window a schematic representation of the variables and their organization in areas and axes is shown. When the mouse is moved over this representation those elements that we can modify, i.e. variables, axes and areas will be highlighted.



Select a variable, and click to change the properties of the same

If we want change, for example, the representation properties of the phase 1 voltage distortion variable, place the cursor here and click with the left mouse button.



Screen configuration of the representation of a variable

This screen will allow us to configure the type of representation (Lines, bars, or points), colour, line style (only if you select the type of representation in the form of lines), the dot style (only if you select the type of representation in the form of dots) and the thickness of the line (only if you select the type of representation in the form of lines).

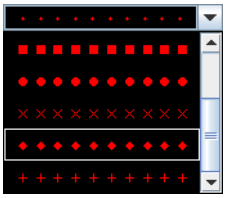
In the event that we have selected the type of representation in lines, we can choose the style from five different possibilities, solid, dashed, dotted, dash –dot and dash-dot –dot .

Selecting the line style

We may also choose the line thickness.

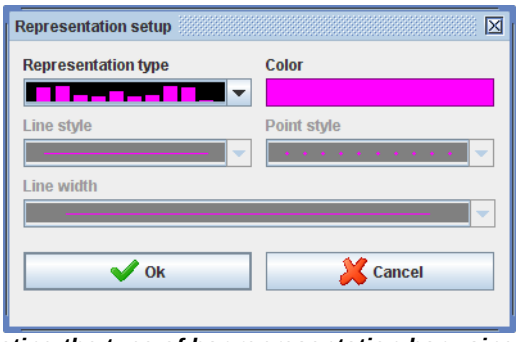
Selecting the line thickness

If the kind of representation we have selected is dots, we can select the type of dots.



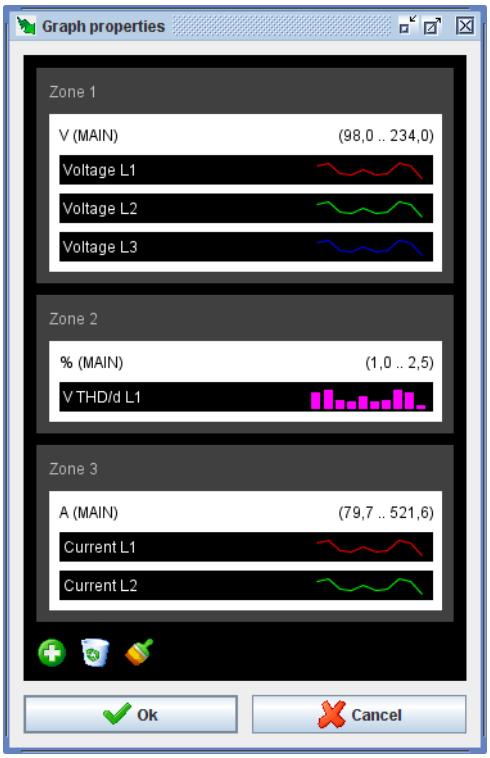
Selecting the type of dots

Suppose that in the example we modify the representation of the bar variable and change the colour to a deep lilac. Note that it is possible to change the colour for any kind of representation by clicking with the left mouse button on the colour chart.



Selecting the type of bar representation bar using lilac

This selection will be reflected in the screen properties of the graph.



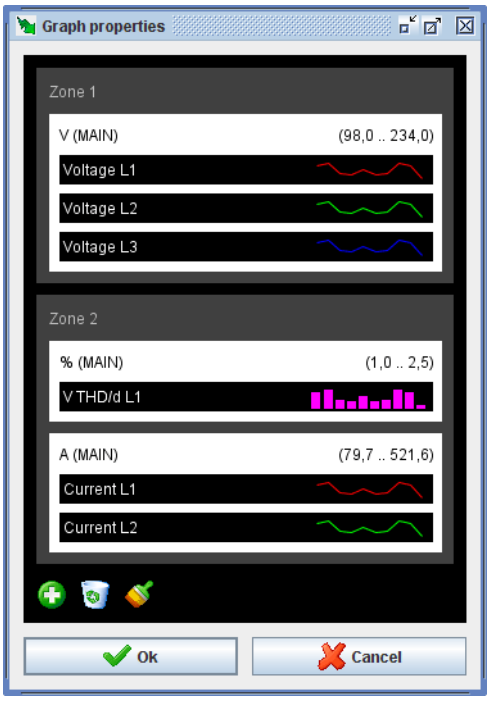
Change in representation properties of a variable

A final property that can be changed on a variable is its position on the overall chart. To make this change simply drag the variable that we want to modify to its new location. While dragging the variable we will be informed of the positions where we can "drop" the variable and where not, using the red or green squares. Thus, a variable cannot be "released" on another variable (does not make sense) or on an axis (with a white background) with units different to those of the units of the variable that we are "releasing". We can, however, "release" the variable on any area (even on the same area but in another position), on an axis that has the same units as the variable that we are "releasing" (even within the same axis, but in another position) or "out", i.e. between areas on the first zone or under the last.

If we "release" the variable on an axis with the same units the variable will be added to that variable in the order in which we have entered it. The order in which they are placed is the order they are painted, so that the last variable of an axis is that which is painted in the last place and, therefore, that which will be represented on the others (and therefore can hide the others). It is often useful to place the variables representing bars in the first place because otherwise they will almost entirely hide the others.

If we "release" the variable on a zone a new axis will be created in this area. This new axis will share the drawing area with the other axes of the area and will be painted in the order in which they have been "released".

If we "release" the variable "outside" an area will be created with an axis in that position. It should be borne in mind that if the variable was the only one on the axis, that axis will be removed and if, moreover, that axis was the only one in your area, that area will be removed as well. We can also drop that variable in the trash, at the bottom of the graph properties screen; this action deletes the variable of the graph. In the example we are going to move the distortion variable in the area where the currents are, at the top in order for it to be painted first.



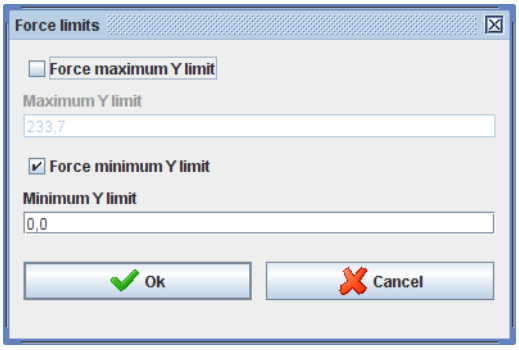
Moving a variable in another area

With this we can create a new axis within the area where the currents are found. Note that the area where the variable was found has disappeared and, therefore, and now the graph contains two areas. Note also that in the second zone, the distortion axis is painted first, and therefore the distortion variable of phase 1 and after the current, first phase 1 and then phase 2.

In this case we get a graph as follows:

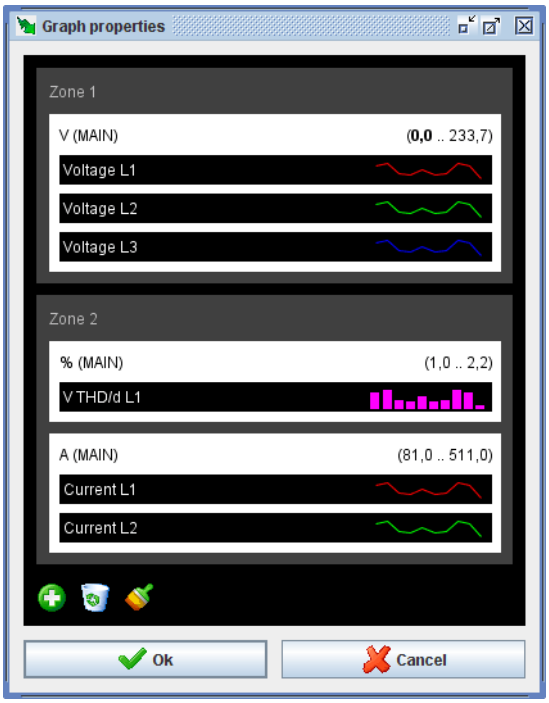
Graph with two zones and two axes in an area

The axes of a graph can also be configured through the properties window. To do so, once in this window, you must click on the axis that we want to configure and the following window will appear:



Configuration window of a shaft

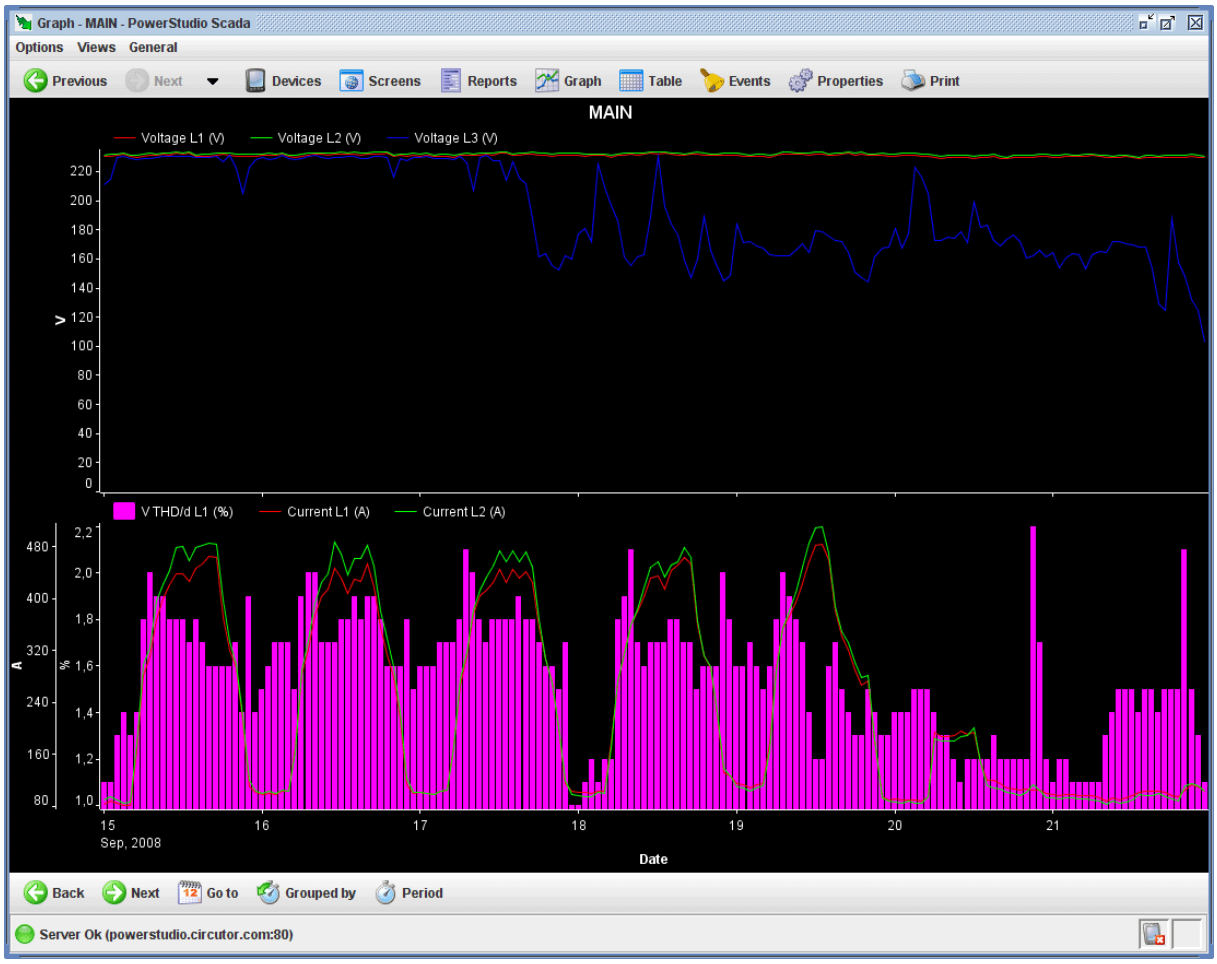
We can see that this window will allow us to force the limit values of the axis in its Y-coordinate. By default the graphic engine defines the limits which enable all the value of a variable to be shown, however it is possible to modify them manually through this option. In the example we are going to force the minimum Y limit value of the axis where the voltages of the phases are zero.



Properties with the minimum limit of a forced axis

Note that on the axis units of the properties the units, the equipment the variables in brackets belong to (provided the variables are from only one device) and the limits of the Y-axis (the minimum and maximum value, in bold if this value is forced by the user) can be seen.

Like variables, axes can redistributed using the drag and drop method. The operation is the same as dragging and dropping a variable. So, an axis can be released on another with the same units, on another area (or on the same area but in another position), or "out" in the trash (deleting all the variables contained).



Graph where we have forced the interior limit of a Y-axis

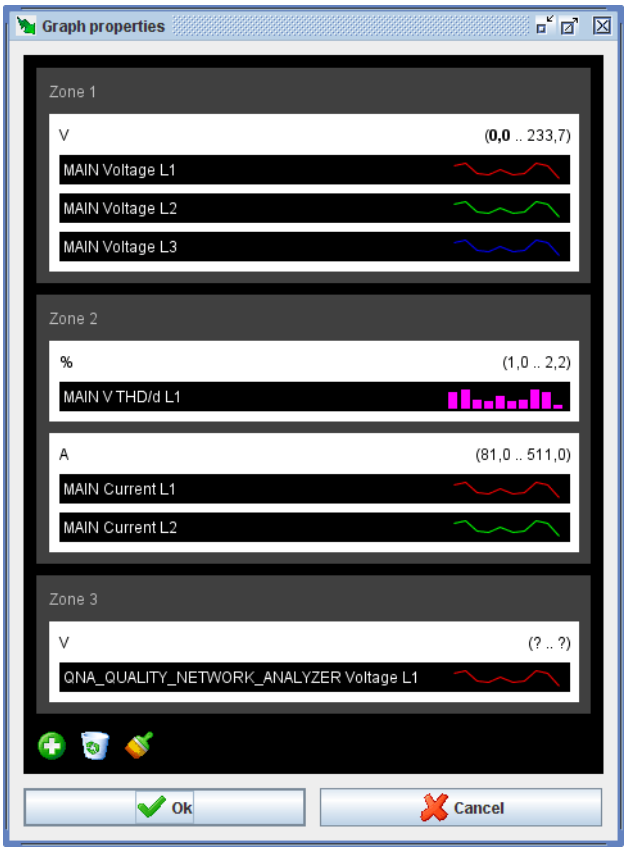
Finally, the only configuration of the areas that we may change is its position. So, like variables and axes, a zone can be dragged to another position, but only within another, "outside" or to the trash (deleting all axes and variables that it contains).

Trash

One of the most interesting possibilities offered by the property screen is to add new variables to the chart. This is done by clicking on the button with the sign “+” "located on the lower left.

Add new variables to the graph

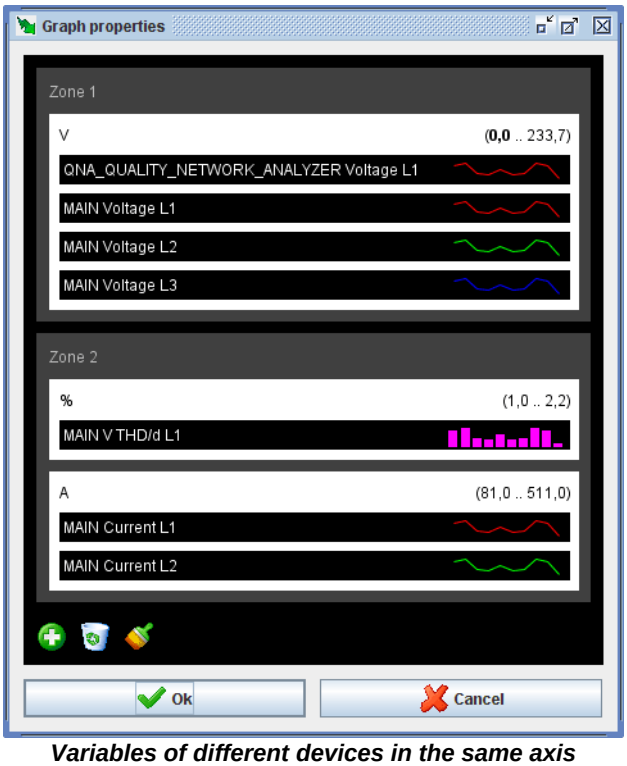
Then we have the windows for selecting equipment and variables, allowing us to add other variables, including from a different device. In the example we have added a phase 1 voltage variable from other equipment.



Adding a variable from another device

Note that the device information has disappeared from the axes and appears on each variable because now there are no variables of a single device represented. The new variable (or new variables, if we had chosen several) are organized into new areas at the end and the limits of the new lines are unknown because the limits have not yet been loaded with data, although they may be forced by the user.

In the example we have dragged the new variable onto the axis of the first zone, particularly on the top of the axis, leaving the new variable as the first on the list. Note how the axis limits have been inherited where we have released them.



Variables of different devices in the same axis

One detail to remember is the fact that dragging the variable to its new position we have two variables in the same axis, and the same area, with the same colour. This may be a problem for display.

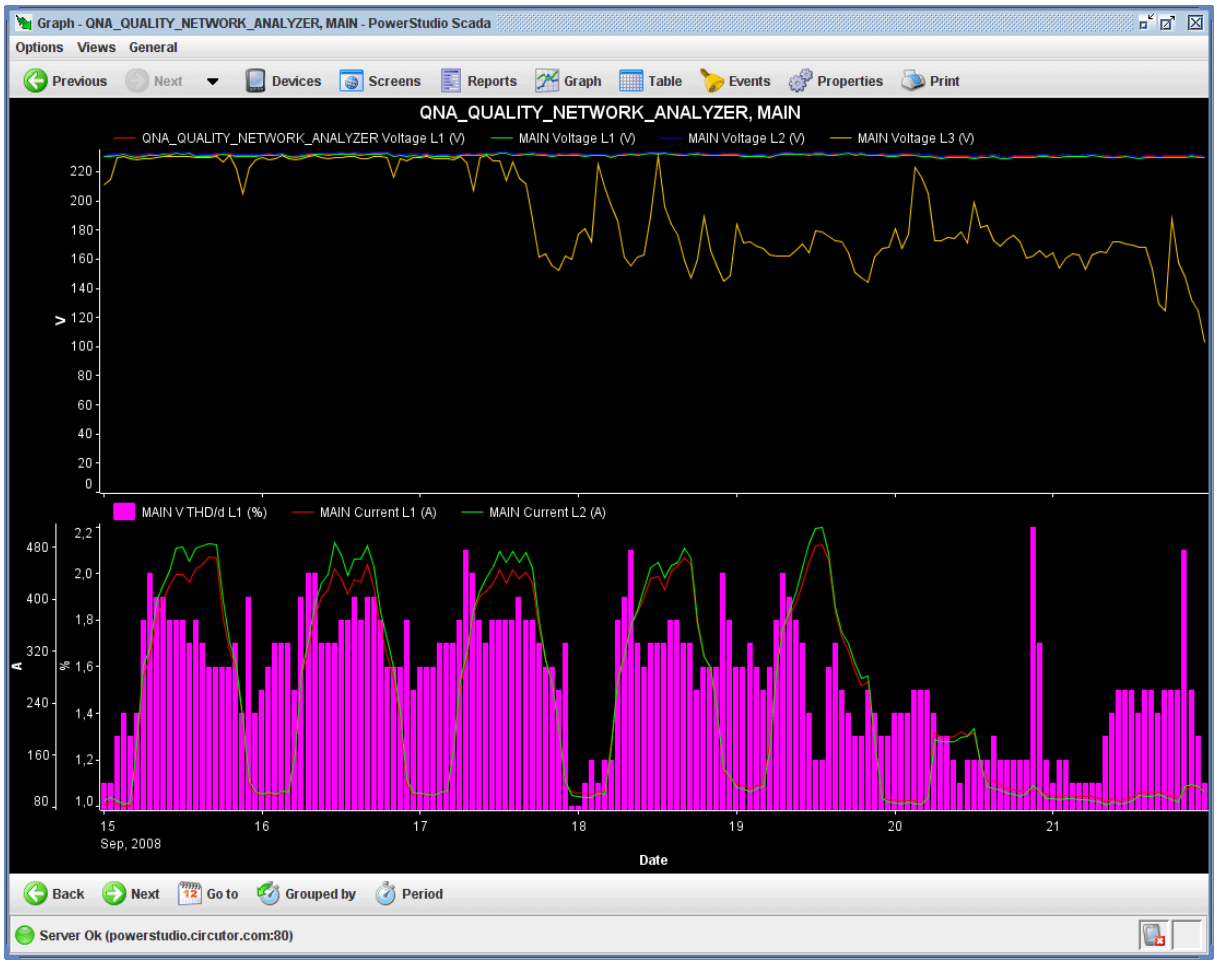
There are two ways to solve the problem, the first is to change by hand the colour of the representation of one of the variables and the second is to let the program decide the appropriate distribution of colours by itself. This latter is done by clicking on the button represented by a brush.

Intelligent distribution colour brush

Clicking on this button the program will decide whether there are any problems with displaying variable colours and will change the variables that it deems appropriate.

Intelligent automatic change of colours

The resulting figure would be as follows:



Graph with variables from multiple devices

12.2.8.7 Printing a graph

The user can print the actual page of the graph at any time using “print” in the menu “Options” of the main menu or the "Print" button of the upper toolbar. Note that this option, unlike that in the SCADA screens, is enabled for graphs.

12.2.8.8 Export graph

The user may at any time export the graph being viewed in a PNG format. This option should be accessed through “Export" in the “Options" menu of the main menu. Note that this option, unlike that in the SCADA screens, is enabled for graphs.

Note that when you export a graph this is done with a white background to facilitate the inclusion of it in reports, studies, etc.

12.2.8.9 Types of graph

So far we have seen standard graph types, i.e. a graph which consists of a number of areas, and where each zone has an X-axis which is a time interval while the Y-axis are the values of the variables. However, there are certain types of graphs that have certain distinct characteristics.

A special graph would be a harmonics graph. This chart is provided by equipment which calculates harmonics variables, whether it is voltage or power. For example, we find this kind of graph on QNA equipment, among others, and can provide the outage of voltage in each phase.

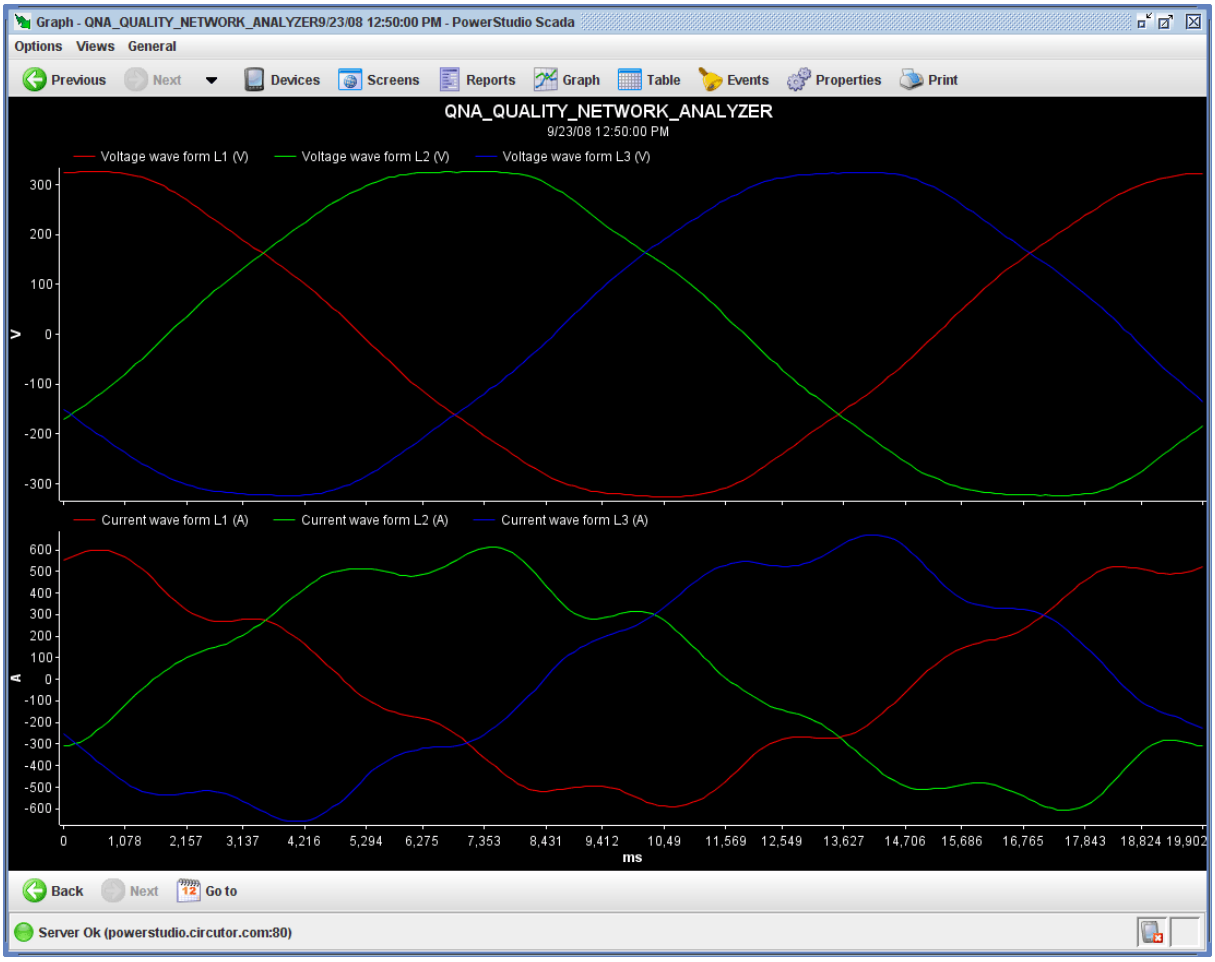
Harmonics graph

This type of graph has some special features:

- ***Subtitle:*** In the caption under the title of the graph, indicating the date to which the harmonic decomposition being viewed belongs to.
- ***X-axis:*** The X- axis does not represent time, but the harmonic number. It therefore lacks units.
- ***Toolbar:*** The toolbar contains only 3 buttons that will allow us to move to other records, namely it will enable us to move to earlier records, to the following ones or go directly to the records closest to a date specified by the user ("Go to" option).
- ***Properties:*** The configurable properties of this type of graph are the same as with a standard graph, the only difference being that only variables from equipment containing this type of variable are available.
- ***Representation using bars:*** As a special feature, this adopts bars as a default representation, but these can be set up afterwards.

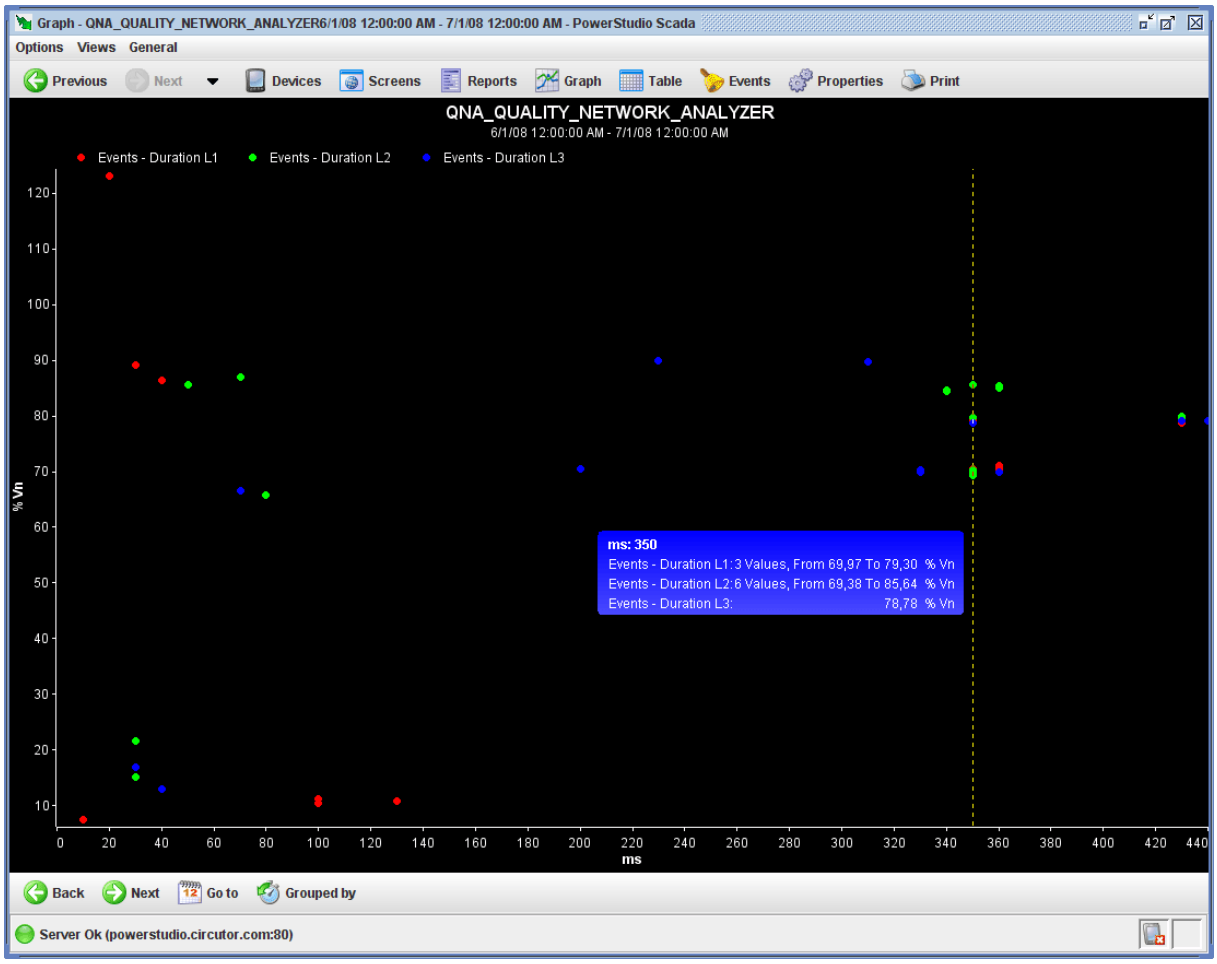
Another special feature graph is the waveform graph, generated by QNA equipment, which can provide a screenshot of the voltage waveform and the current in each one of the phases.

The characteristics of this graph are very similar to the harmonics graph. The only differences are that the X-axis units are milliseconds and that the representation is in lines by default. Only variables of this type may be added to this type of graph, i.e., waveforms.



Waveform graph of a QNA

Another special graph is the event duration graph

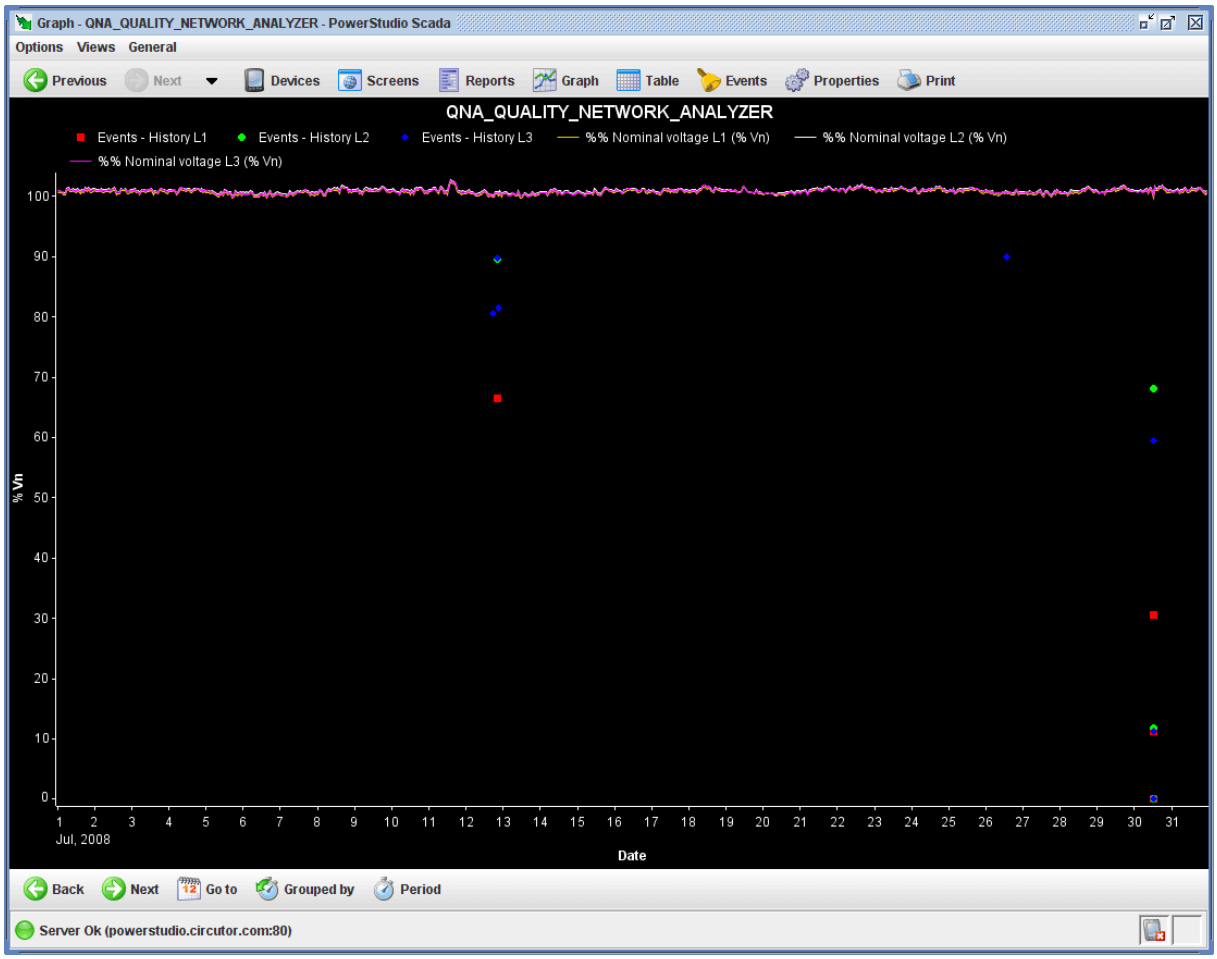


QNA event duration graph

This type of graph represents the voltage events registered during a period of time, organized according to their duration. This graph has some special features:

- ***X-axis:*** The X-axis represents the duration in milliseconds.
- ***Representation Interval:*** The events of a time interval configurable by the user are represented.
- ***Toolbar:*** The toolbar allows us to move through the time intervals, as well as defining a new time interval, either pre-defined or fully configurable by the user.
- ***Representation:*** The representation chosen by default is in dots, although it can be changed at will.
- ***Tooltip:*** It is typical to see in such a figure a special tooltip indicating the number of values of the variable that there are just at this point and between which values it can be found as it is normal that many values are repeated with certain duration.
- ***Subtitle:*** Unlike the harmonics and waveform graph, the subtitle here will tell us the time interval we are viewing.
- ***Adding new variables:*** Only variables of the type we are viewing can be added, i.e., duration of events.

Another unusual graph is that of logged events.

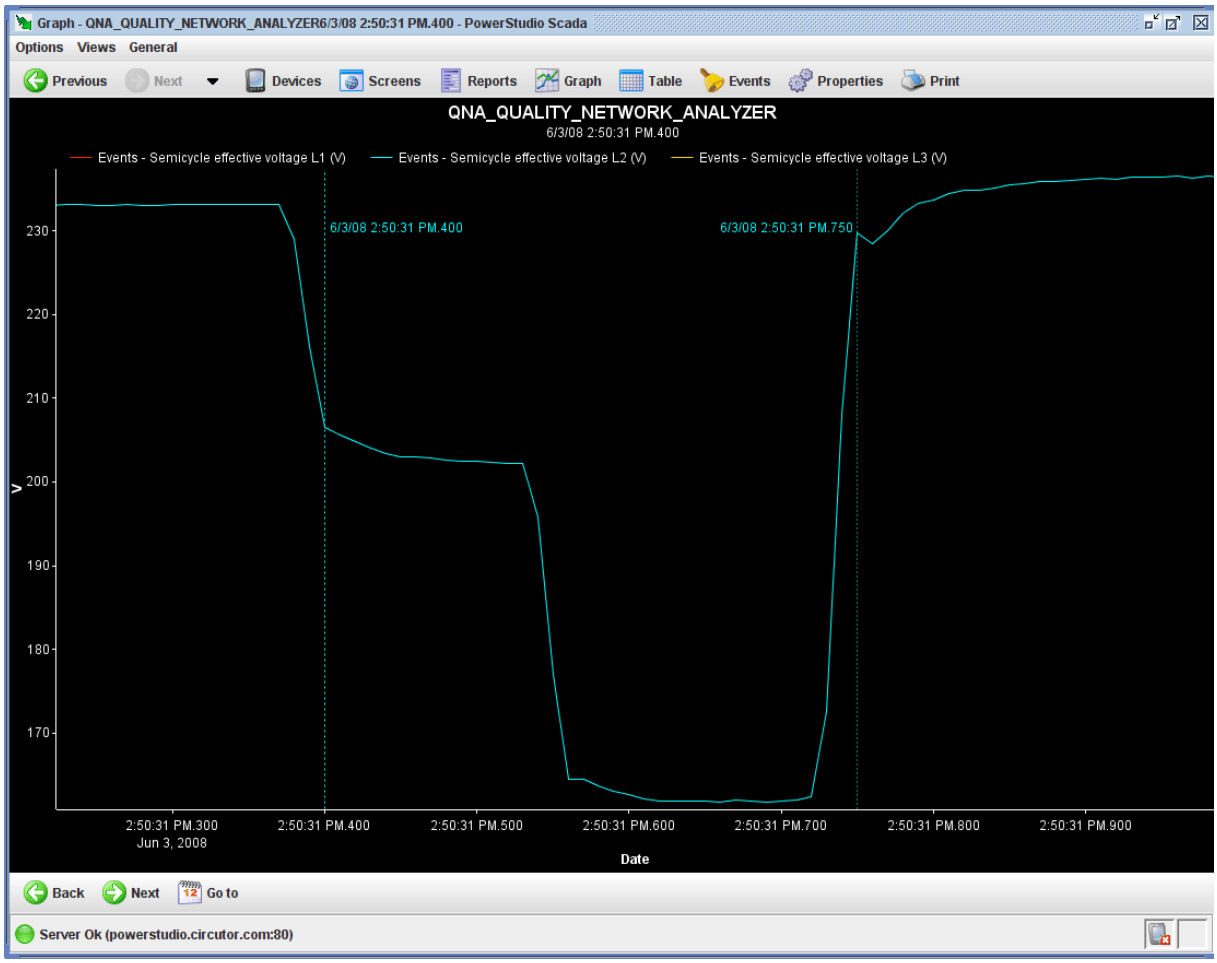


Graph of logged events

This figure is essentially equivalent to a standard graph, with all the characteristics of one. The only difference is that each event is depicted as a dot plus a horizontal line whose length equals the duration of the event represented.

Usually the values of events this graph shows are accompanied by nominal voltage. In both cases the units are expressed as a percentage of the nominal value. Any other standard variable may also be added.

The last special type of graph is the semi-circular effective voltage graph.



Semi-circular effective voltage graph

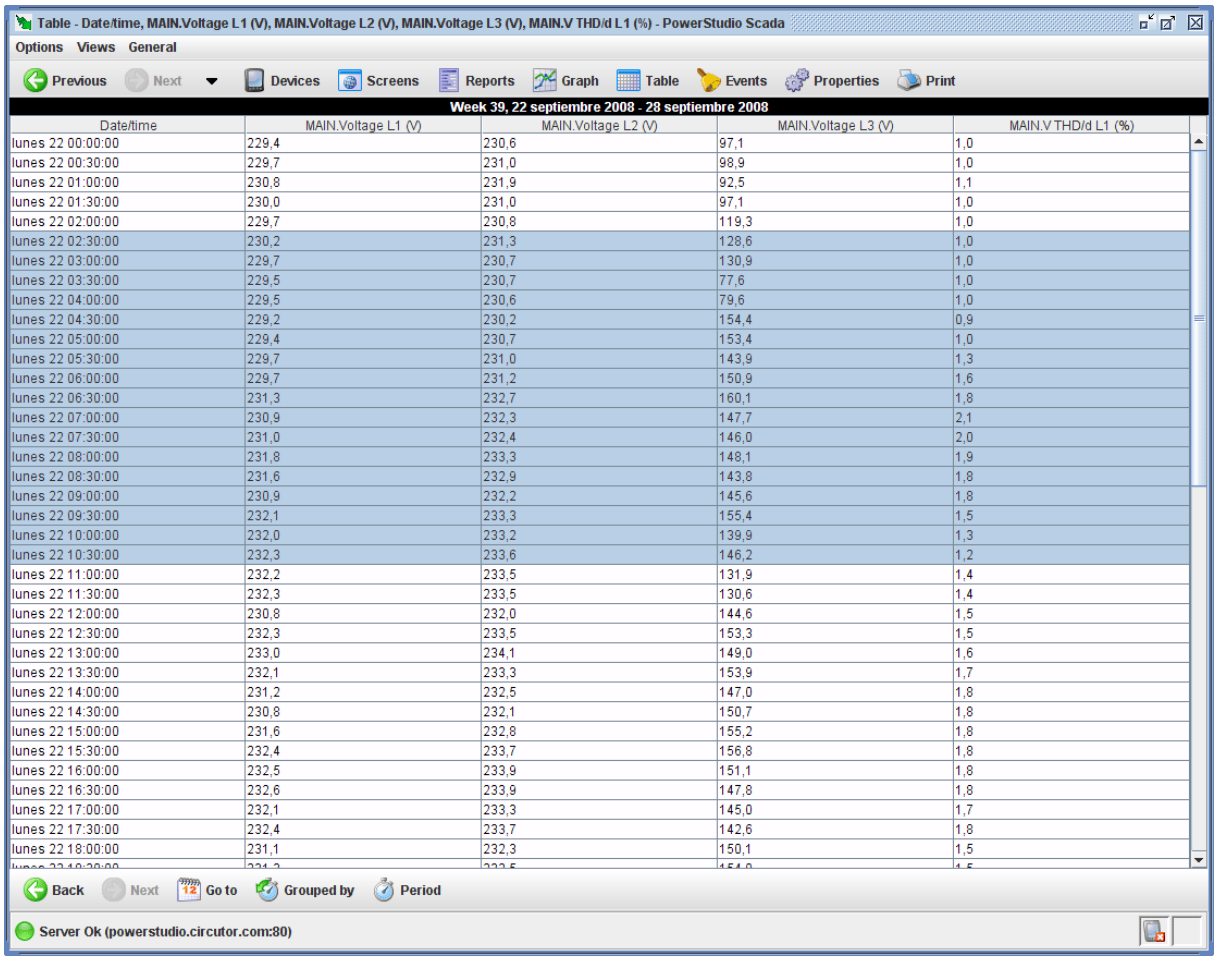
This type of graph represents the evolution of the voltage in a short space of time in semi-circular intervals. These screenshots are made in response to the capture of an event at that time.

Very similar to the waveform graph, with the only difference being that the x-axis consists of dates as in a standard graph, as the semi-circle value capture takes place just at that moment.

12.2.9 Making tables

Another important client tool is the possibility of making value tables of the variable on a piece of equipment. To access this view we can do it through the menu option "*Views*" and then "*Studio*" and finally "*Table*" or directly from the "Table" button in the toolbar. You can make tables from a predefined SCADA screen where a control table has been added or from buttons defined for this purpose in the monitoring view of a device (for example, the monitoring view of a QNA).

Typically, to make a table it is necessary to choose what variables from which devices will be part of it. The selection of these variables is done in the same manner as for generating a graph. After making the selection we get a table like this:



Date/time	MAIN.Voltage L1 (V)	MAIN.Voltage L2 (V)	MAIN.Voltage L3 (V)	MAIN.V THD/d L1 (%)
lunes 22 00:00:00	229,4	230,6	97,1	1,0
lunes 22 00:30:00	229,7	231,0	98,9	1,0
lunes 22 01:00:00	230,8	231,9	92,5	1,1
lunes 22 01:30:00	230,0	231,0	97,1	1,0
lunes 22 02:00:00	229,7	230,8	119,3	1,0
lunes 22 02:30:00	230,2	231,3	128,6	1,0
lunes 22 03:00:00	229,7	230,7	130,9	1,0
lunes 22 03:30:00	229,5	230,7	77,6	1,0
lunes 22 04:00:00	229,5	230,6	79,6	1,0
lunes 22 04:30:00	229,2	230,2	154,4	0,9
lunes 22 05:00:00	229,4	230,7	153,4	1,0
lunes 22 05:30:00	229,7	231,0	143,9	1,3
lunes 22 06:00:00	229,7	231,2	150,9	1,6
lunes 22 06:30:00	231,3	232,7	160,1	1,8
lunes 22 07:00:00	230,9	232,3	147,7	2,1
lunes 22 07:30:00	231,0	232,4	146,0	2,0
lunes 22 08:00:00	231,8	233,3	148,1	1,9
lunes 22 08:30:00	231,6	232,9	143,8	1,8
lunes 22 09:00:00	230,9	232,2	145,6	1,8
lunes 22 09:30:00	232,1	233,3	155,4	1,5
lunes 22 10:00:00	232,0	233,2	139,9	1,3
lunes 22 10:30:00	232,3	233,6	146,2	1,2
lunes 22 11:00:00	232,2	233,5	131,9	1,4
lunes 22 11:30:00	232,3	233,5	130,6	1,4
lunes 22 12:00:00	230,8	232,0	144,6	1,5
lunes 22 12:30:00	232,3	233,5	153,3	1,5
lunes 22 13:00:00	233,0	234,1	149,0	1,6
lunes 22 13:30:00	232,1	233,3	153,9	1,7
lunes 22 14:00:00	231,2	232,5	147,0	1,8
lunes 22 14:30:00	230,8	232,1	150,7	1,8
lunes 22 15:00:00	231,6	232,8	155,2	1,8
lunes 22 15:30:00	232,4	233,7	156,8	1,8
lunes 22 16:00:00	232,5	233,9	151,1	1,8
lunes 22 16:30:00	232,6	233,9	147,8	1,8
lunes 22 17:00:00	232,1	233,3	145,0	1,7
lunes 22 17:30:00	232,4	233,7	142,6	1,8
lunes 22 18:00:00	231,1	232,3	150,1	1,5

Table of values

Note that the typical value table consists of three parts:

- ***Title:*** This usually indicates what data period we are viewing, although in special tables it may contain other information.
- ***Body:*** This contains a series of columns with the values each variable has in each register. Each column is a variable and contains a header with the same title.
- ***Toolbar:*** As in the graph, the grouping and the period of the data displayed can be configured.

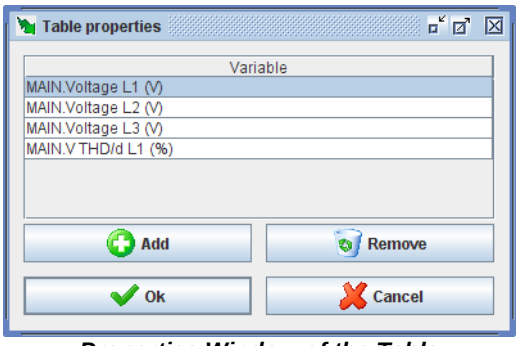
There is a direct equivalence between the tables and graphs, that is, the same type of graph and table show the same values but in different formats and, obviously, with different configuration capacities.

This feature is used by the PowerStudio client to deduce what graph or table we want to carry out when on a graph or table display. That is, if we are displaying a chart and we click on the button of

the client table, PowerStudio will deduce that we want to see the representation as a table of the variables represented in the graph, and will immediately show this. Similarly, if we are viewing a table and we click on the graph button, PowerStudio client will deduce that we want to see the graph of the variables shown on the table.

The operation of the toolbar is absolutely the same as the operation of the same bar on the graph view.

It is possible to configure some aspects using the option of "*Properties*" from the table. This option can be accessed through the menu "*Options*", submenu "*Properties*" or directly through the button "Properties" on the main toolbar.



Properties Window of the Table

Through this window you can add new variables to the table in the same way as they are added to the graph, by clicking on "*Add*". It is also possible to delete variables from the table, simply by selecting the variables that we want to remove and clicking on the "*Delete*" button.

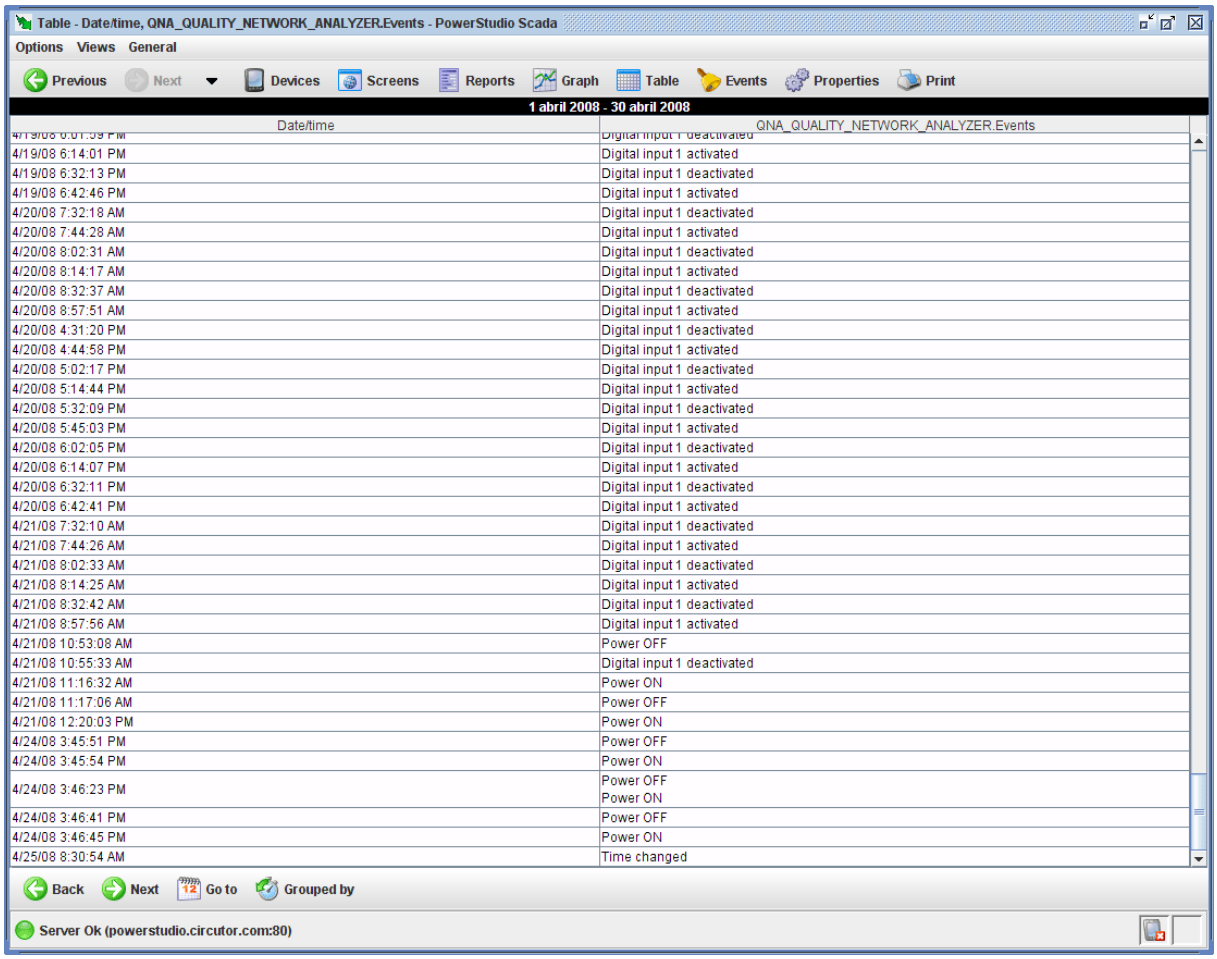
As with the graphs, the user can print the actual page of the graph at any time using the "*Print*" option in the "Options" menu of the main menu or the "Print" button of the upper toolbar. Note that this option, unlike that in the SCADA screens, is enabled for tables.

It is also possible to export this table by clicking "*Export*" in the "*Options*" menu of the main menu. It will be exported in text format, where each line of text is a row of the table and where each column is separated by the symbol ";".

A common feature in all tables is that they can be sorted by columns by clicking on them. By default, tables usually appear sorted by date, usually the first column, but they can be ordered by other variables. By clicking on the title of a column it will be ordered in ascending order, if we click again on the same place it will be ordered in descending order and a third click will bring it back to its original format.

A column may also be ordered so that a second column can be ordered depending on the first. For example, if we have a column that represents a type of group to which each row belongs to and another which represents a numerical value associated with each row, we can order first by the column group by clicking on the column title and then, pressing the "CTRL" key, clicking on the title of the column that represents the magnitude (once for ascending order and twice for descending order). This will order the table by group, and within each group, by size.

QNA equipment allows a special table to be made called "Events" that lets you view a list of events recorded by the equipment. This table can only be viewed from the corresponding button on the monitoring screen of the equipment and does not correspond with any graph view.



Timetable of QNA events

The table has two columns; the first is the date and time when the incident occurred while the second is the description of it.

As you can see, this table does not allow the properties of the screen to be changed, nor the variable period (which would not, on the other hand, make any sense). However it is possible to print it in same way as other tables.

Special graphs have their equivalent table, and therefore we have table equivalents to harmonics graphs, waveforms, logged events, duration of events and efficient voltage semi-circle events.

The table of logged events has the peculiarity that for every event we can visualize a lot of information:

- ***Event Type:*** An icon at the beginning of information indicating whether it is a gap, an interruption or overvoltage.
- ***Value of the event:*** This indicates the most representative value of the event. If this is an overvoltage this value is the highest achieved by the event, in other cases this is the minimum value reached. It is expressed as a percentage of the nominal voltage.
- ***Duration:*** The first value in brackets indicates the duration of the event.
- ***Average voltage:*** Indicates average voltage of the event, expressed as a percentage of the nominal voltage.
- ***Previous Voltage:*** Indicates the voltage there was at the beginning of the event, expressed as a percentage of the voltage.

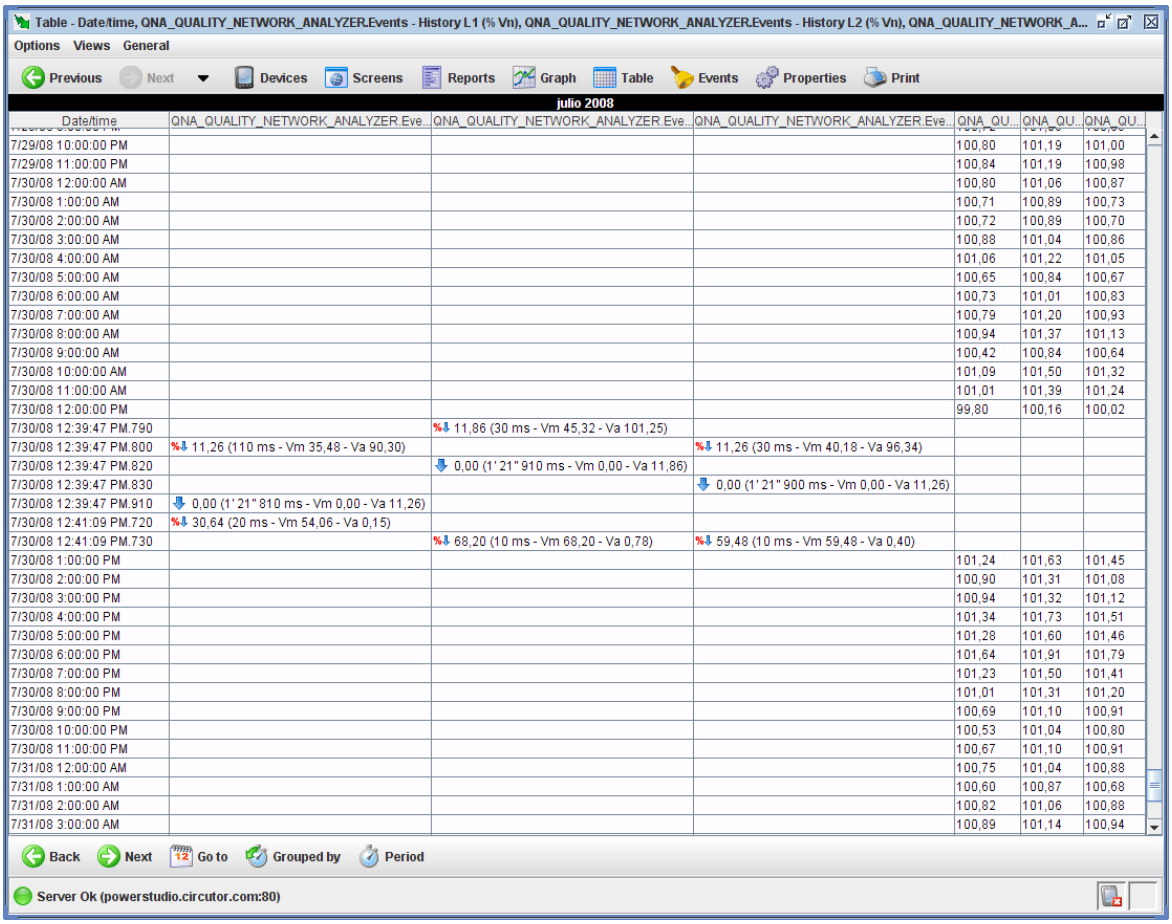
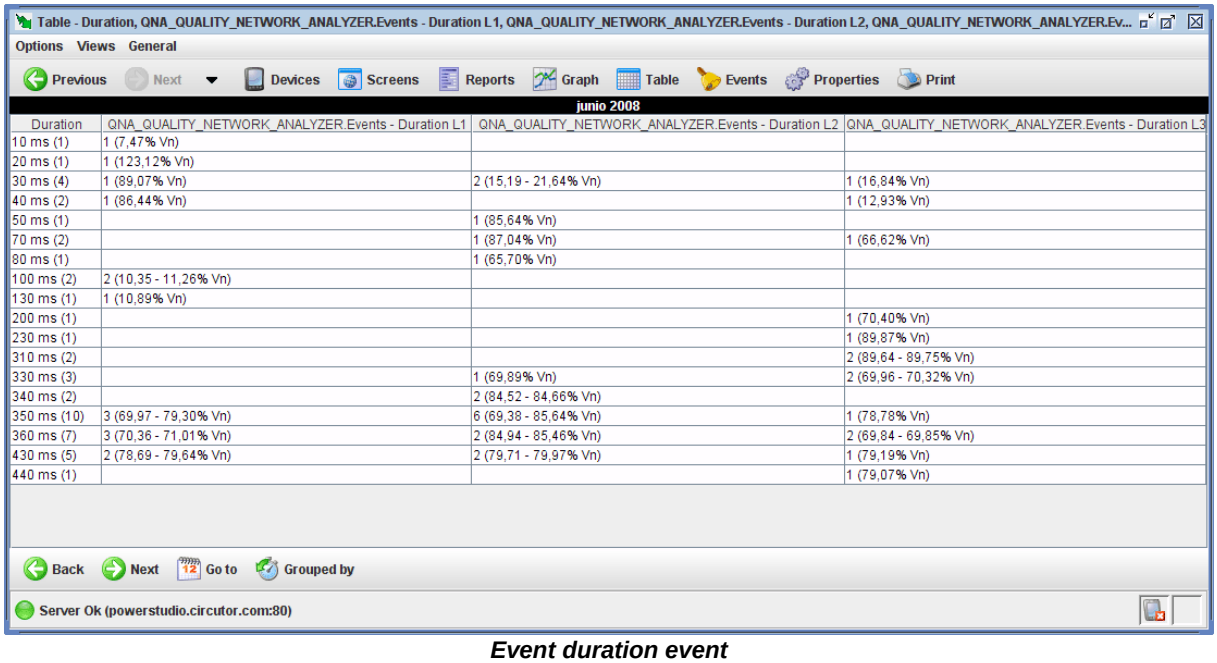


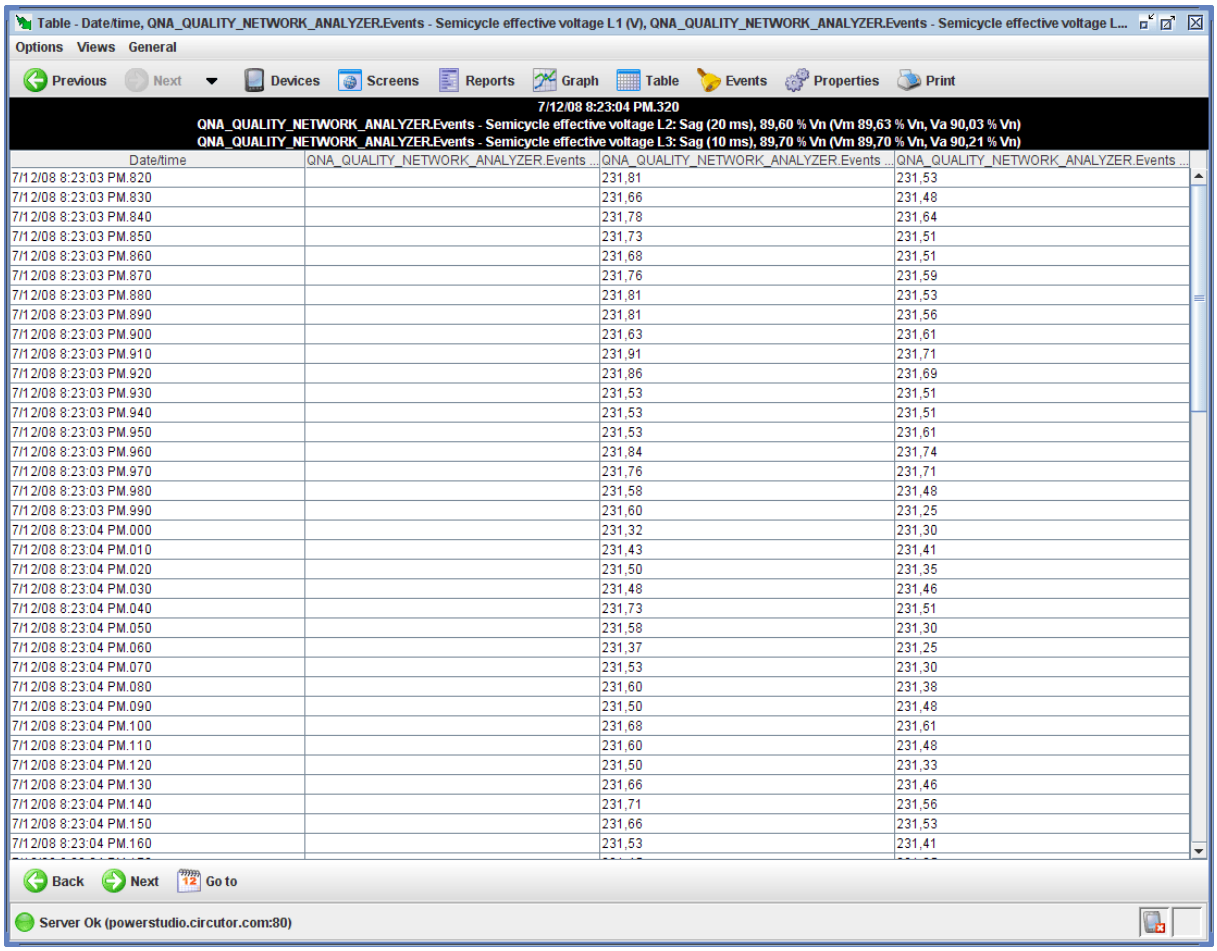
Table of historic events

The duration table shows a list where the first column contains the duration of the events in the interval shown. Apart from the length in itself, it shows the number of events of the interval with this duration (irrespective of the phase). In each column of each variable a number of events from that phase is indicated and between brackets the value of the event (if there is more than one event in this phase with this duration, the minimum and maximum value of the events that have this duration in this phase are indicated).



Event duration event

Harmonic tables and waveforms show the same information as the equivalent graph but as a list, however, the efficient semi-circle voltage table shows more information.



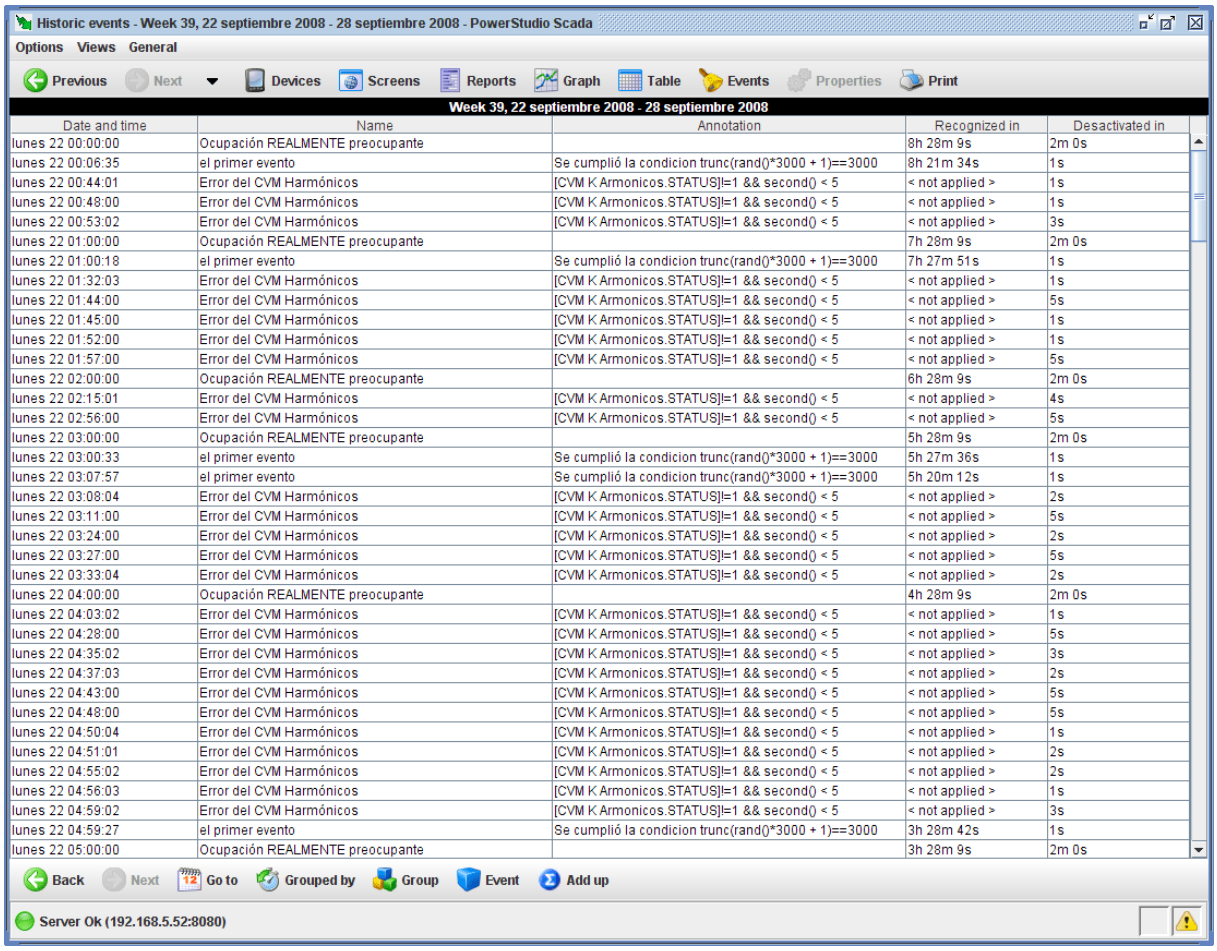
Date/time	QNA_QUALITY_NETWORK_ANALYZER.Events ...	QNA_QUALITY_NETWORK_ANALYZER.Events ...	QNA_QUALITY_NETWORK_ANALYZER.Events ...
7/12/08 8:23:03 PM.820		231,81	231,53
7/12/08 8:23:03 PM.830		231,66	231,48
7/12/08 8:23:03 PM.840		231,78	231,64
7/12/08 8:23:03 PM.850		231,73	231,51
7/12/08 8:23:03 PM.860		231,68	231,51
7/12/08 8:23:03 PM.870		231,76	231,59
7/12/08 8:23:03 PM.880		231,81	231,53
7/12/08 8:23:03 PM.890		231,81	231,56
7/12/08 8:23:03 PM.900		231,63	231,61
7/12/08 8:23:03 PM.910		231,91	231,71
7/12/08 8:23:03 PM.920		231,86	231,69
7/12/08 8:23:03 PM.930		231,53	231,51
7/12/08 8:23:03 PM.940		231,53	231,51
7/12/08 8:23:03 PM.950		231,53	231,61
7/12/08 8:23:03 PM.960		231,84	231,74
7/12/08 8:23:03 PM.970		231,76	231,71
7/12/08 8:23:03 PM.980		231,58	231,48
7/12/08 8:23:03 PM.990		231,60	231,25
7/12/08 8:23:04 PM.000		231,32	231,30
7/12/08 8:23:04 PM.010		231,43	231,41
7/12/08 8:23:04 PM.020		231,50	231,35
7/12/08 8:23:04 PM.030		231,48	231,46
7/12/08 8:23:04 PM.040		231,73	231,51
7/12/08 8:23:04 PM.050		231,58	231,30
7/12/08 8:23:04 PM.060		231,37	231,25
7/12/08 8:23:04 PM.070		231,53	231,30
7/12/08 8:23:04 PM.080		231,60	231,38
7/12/08 8:23:04 PM.090		231,50	231,48
7/12/08 8:23:04 PM.100		231,68	231,61
7/12/08 8:23:04 PM.110		231,60	231,48
7/12/08 8:23:04 PM.120		231,50	231,33
7/12/08 8:23:04 PM.130		231,66	231,46
7/12/08 8:23:04 PM.140		231,71	231,56
7/12/08 8:23:04 PM.150		231,66	231,53
7/12/08 8:23:04 PM.160		231,53	231,41

Efficient semi-circle voltage table

As shown in the title of the table the data concerns the event that the screen shot belongs to, namely the date of the event, the type, the duration, the value, the average voltage of the event and the previous voltage.

12.2.10 Displaying logged events

Another important client tool is the possibility creating tables where information about past events is shown. To access this view we can do it through the menu option "Views" and then "Events" and finally “Event browser” or directly from the “Events” button on the toolbar. A table of events from a SCADA screen can be created where the event display control can be added



Date and time	Name	Annotation	Recognized in	Desactivated in
lunes 22 00:00:00	Ocupación REALMENTE preocupante		8h 28m 9s	2m 0s
lunes 22 00:06:35	el primer evento	Se cumplió la condicion trunc(rand()*3000 + 1)==3000	8h 21m 34s	1s
lunes 22 00:44:01	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	1s
lunes 22 00:48:00	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	1s
lunes 22 00:53:02	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	3s
lunes 22 01:00:00	Ocupación REALMENTE preocupante		7h 28m 9s	2m 0s
lunes 22 01:00:18	el primer evento	Se cumplió la condicion trunc(rand()*3000 + 1)==3000	7h 27m 51s	1s
lunes 22 01:32:03	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	1s
lunes 22 01:44:00	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	5s
lunes 22 01:45:00	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	1s
lunes 22 01:52:00	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	1s
lunes 22 01:57:00	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	5s
lunes 22 02:00:00	Ocupación REALMENTE preocupante		6h 28m 9s	2m 0s
lunes 22 02:15:01	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	4s
lunes 22 02:56:00	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	5s
lunes 22 03:00:00	Ocupación REALMENTE preocupante		5h 28m 9s	2m 0s
lunes 22 03:00:33	el primer evento	Se cumplió la condicion trunc(rand()*3000 + 1)==3000	5h 27m 36s	1s
lunes 22 03:07:57	el primer evento	Se cumplió la condicion trunc(rand()*3000 + 1)==3000	5h 20m 12s	1s
lunes 22 03:08:04	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	2s
lunes 22 03:11:00	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	5s
lunes 22 03:24:00	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	2s
lunes 22 03:27:00	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	5s
lunes 22 03:33:04	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	2s
lunes 22 04:00:00	Ocupación REALMENTE preocupante		4h 28m 9s	2m 0s
lunes 22 04:03:02	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	1s
lunes 22 04:28:00	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	5s
lunes 22 04:35:02	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	3s
lunes 22 04:37:03	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	2s
lunes 22 04:43:00	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	5s
lunes 22 04:48:00	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	5s
lunes 22 04:50:04	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	1s
lunes 22 04:51:01	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	2s
lunes 22 04:55:02	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	2s
lunes 22 04:56:03	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	1s
lunes 22 04:59:02	Error del CVM Harmónicos	[CVM K Armonicos.STATUS]!=1 && second() < 5	< not applied >	3s
lunes 22 04:59:27	el primer evento	Se cumplió la condicion trunc(rand()*3000 + 1)==3000	3h 28m 42s	1s
lunes 22 05:00:00	Ocupación REALMENTE preocupante		3h 28m 9s	2m 0s

Table of logged events

This table has two different viewing modes, the normal mode and the total mode. The normal mode (above) table consists of five columns.

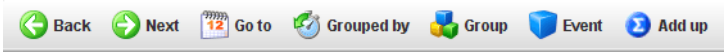
- ***Date and time:*** Indicates the date and time at which the incident occurred.
- ***Name:*** Name of event that occurred.
- ***Annotation:*** Description of the event that occurred, which may have data relating thereto or the execution environment at the time it occurred.
- ***Recognized in:*** Time taken for the event to be acknowledged, whether or not it is finally acknowledged. Leaving the mouse cursor on the cell a tooltip will appear with the date on which the event was recognized.
- ***Deactivated on:*** Time the event took in disabling, if it actually was disabled. Leaving the mouse cursor on the cell a tooltip will appear with the date on which the event was deactivated, if the event existed.

As a standard table, the table of active events shows a time interval. You may move through these intervals or modify them through the toolbar and the first four buttons on the left, as was discussed in the section on graphs.

As with the tables, the user can print the actual page of the graph at any time using the “*Print*” option in the “*Options*” menu of the main menu or the "Print" button of the upper toolbar.

It is also possible to export this table by clicking "*Export*" in the "*Options*" menu of the main menu. It will be exported in text format, where each line of text is a row of the table and where each column is separated by the symbol ";". We can also sort the table by the various columns as desired, for example, we can sort events by duration, or even by type of event and by the duration of each type as explained above in the general table properties.

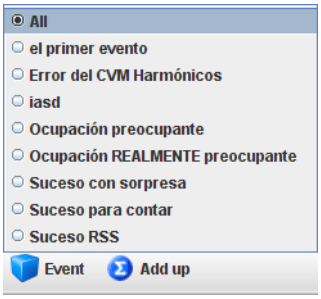
Note that, however, this type of table does not have an available menu of properties that can be used to configure it. However, the toolbar provides some extra options that will allow us a certain degree of configuration for this type of table.



Toolbar of the table of logged events

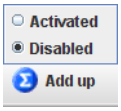
There are a couple of options that allow us to filter the events that we want to see depending on the group they belong to or according to a specific event.

Filtering events by group



Filtering events by individual event

The latter option will allow us to change the display mode. Thus, we can enable or disable the total mode.



Change the display mode by enabling or disabling the total view

If you activate the total view we will have a list as follows:

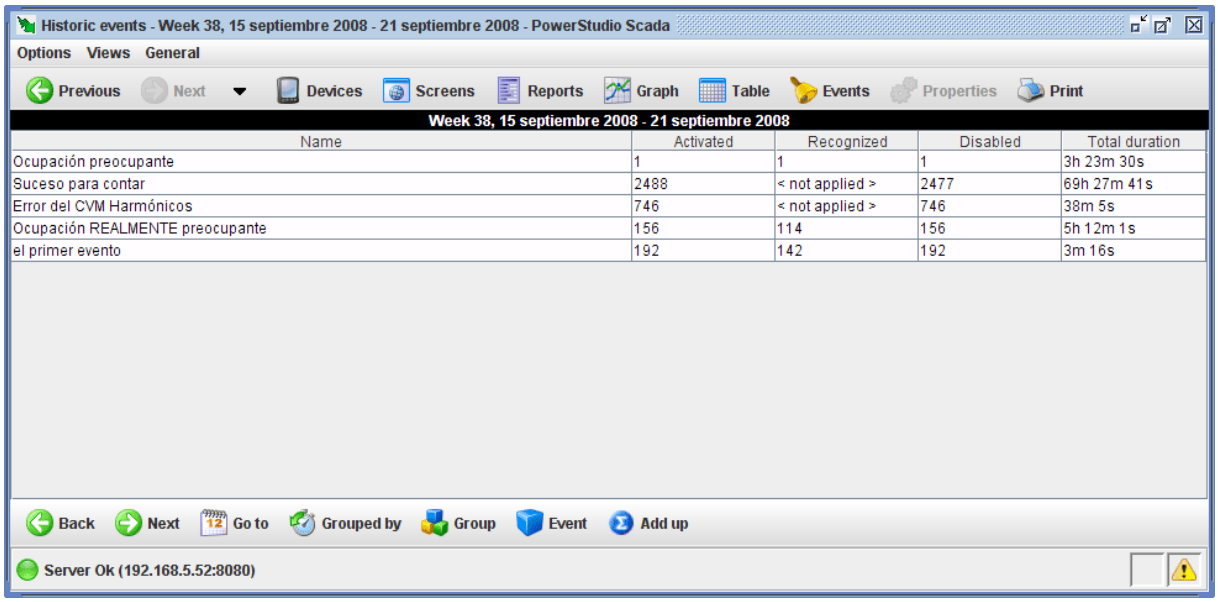


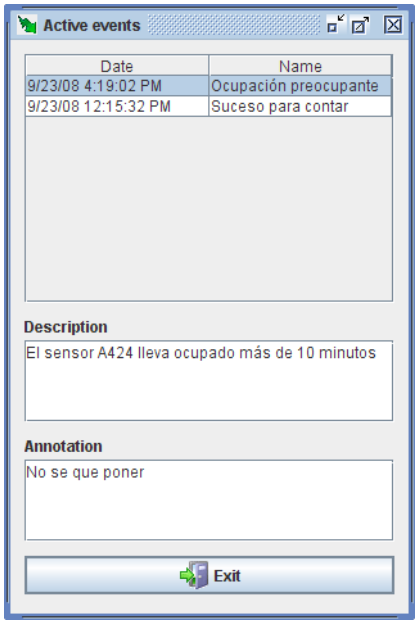
Table of logged events, total mode

In this way the table consists of five columns, one less than in the previous and as many rows as events defined in the environment. The first column indicates the name of the event, the second the number of times it has been enabled in the period to which the data relates (indicated in the title), the third column indicates how many times this event has been acknowledged (or <not applicable> if the incident is not notified), the fourth column indicates how many times it has been disabled and the fifth the total length which the event has been active.

12.2.11 Active and notified events

The powerStudio client enables events that are occurring at the moment to be viewed in real time, both the simple events that are active as well as those that also need to be recognized by the user.

The events that do not require user recognition are displayed in a pop-up window that may be accessed via the menu option "*Views*", then "*Events*" and finally "*Active events*" or directly from the status bar, clicking on the icon that informs us that there are active events in the system. This window can be viewed from a SCADA screen where an active event control has been added.

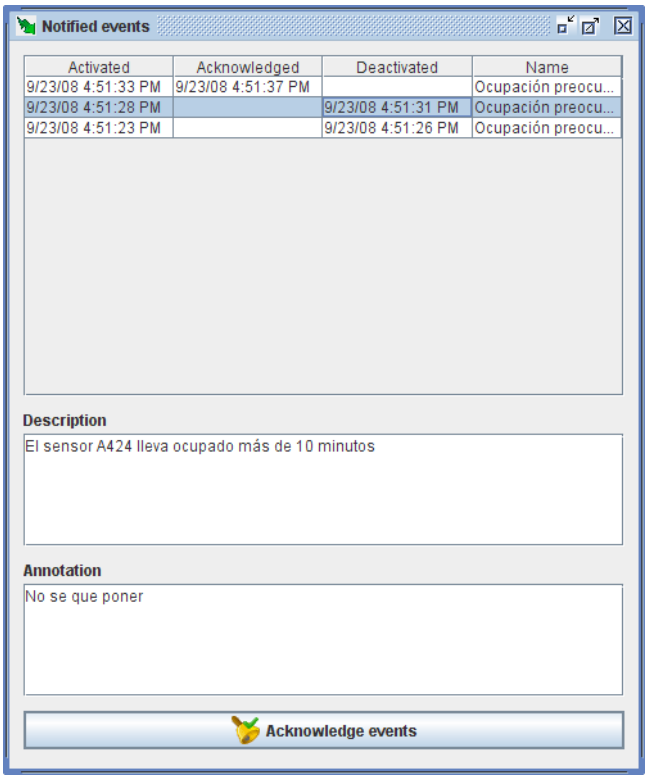


Active event window

We can see the date on which the event was enabled and the name of it. In addition, below, we can see the description that we have selected and the annotation scheduled for the same. This window is purely informative and no action can be carried out here. In addition, it shows both those events that require recognition by the user as those which do not.

On the other hand, the events that require recognition by the user are displayed in a pop-up window that always remains visible and are shown automatically without user intervention when there are events reported active or to be recognised (or both).

The information displayed by this window is very similar to that shown in the active events window, but in addition to showing the activation date and the name of the event; the date is shown when it was recognised by the user and the date it was disabled.



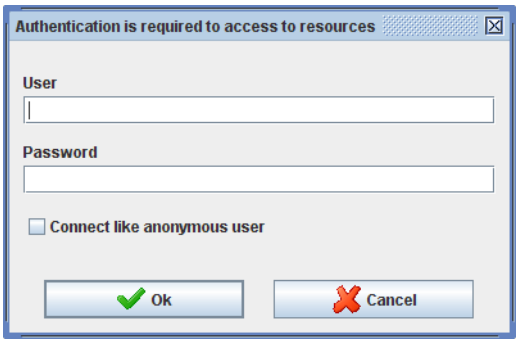
Reported events window

Note that an event with an acknowledgement date and a deactivation date will disappear from the list of events reported, i.e., there will be events on this list without an acknowledgement register, without a disable date, without both dates but not with both dates.

This window allows event recognition. To do this select from the list the events you want to recognize and click the button at the bottom "*Recognize events."* You will see listed the recognition date for the event. When an event is disabled this will disappear from the list. If an event which has already been recognized is recognised again the operation will not produce any effect.

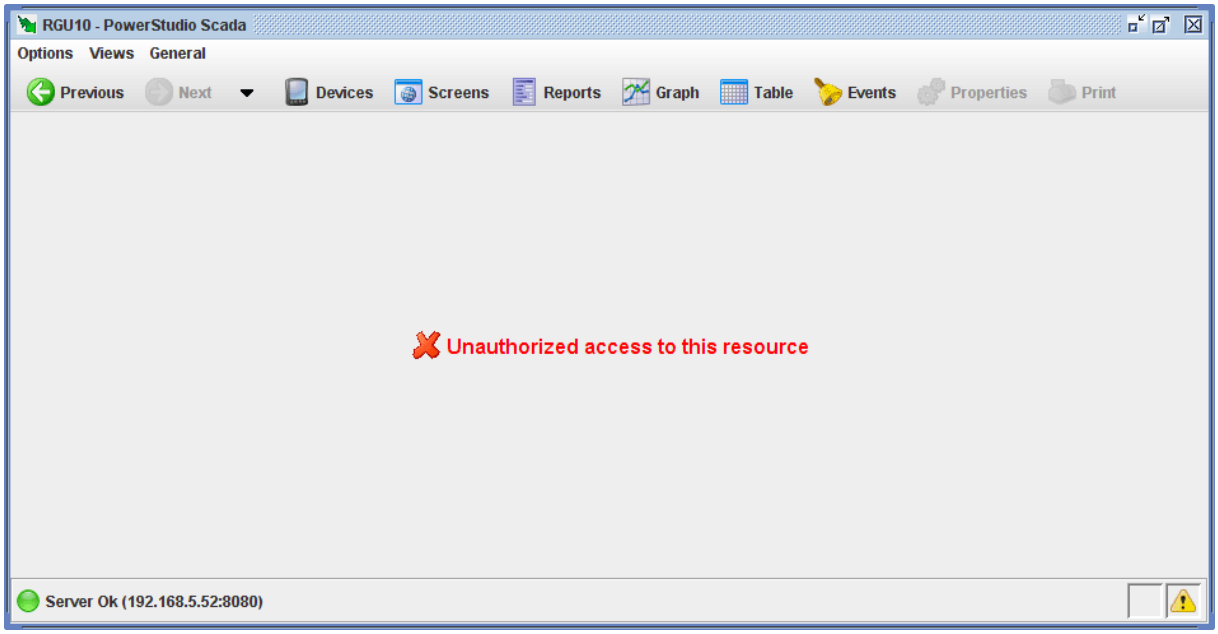
12.2.12 Authentication

If the engine / editor has been enabled for the authentication of users, it is possible that the client asks us to enter the user name and password to access the various resources available. This will be done through a screen like this:



User authentication window

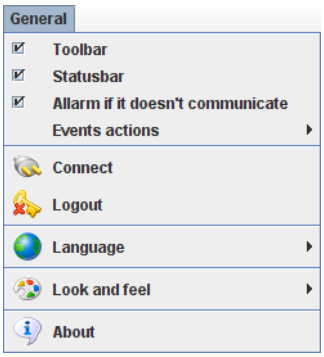
The user must correctly identify themselves to access the resource. If the user and password are unknown we can try a connection as an anonymous user, which provides access to certain resources provided it has been properly configured on the engine / editor. If the user is not identified correctly (you will have three attempts) the customer will not be allowed access to the resource.



Access denied to the resource

It is possible that once authenticated, the client will require new identification when trying to enter an area where they do not have viewing privileges.

In any case, you can always close the current session to force the customer to require user identification again. This can be done via the option "Logout" from the "*General*" menu in the main menu.



"General Menu"

13 System Requirements

- Microsoft Windows versions 2000 (Service Pack 3), 2003 Server, XP Home, XP Professional (Service Pack 1) and Vista for the engine / editor, all in the 32-bit versions.
- Java Virtual Machine JRE 1.6.0 or later for the client application (local and Applet)
- PC Pentium III or greater.
- 256 MB RAM Minimum (512 MB Recommended).
- 200 MB free hard drive (depending on the number and type of equipment connected space should be increased at a rate of approximately 20 MB per device and year of data we want to save).
- CD-ROM.
- SVGA monitor 1024x768 or bigger.
- Windows compatible mouse and keyboard.

In multi-user systems (Windows NT, 2000 and XP), the software will only work properly if installed as administrator or user with administrator privileges.

In 64-bit systems software does not support some features, such as the discriminators or events timetable.

14 Appendices

14.1 Variables

In order to use references to the variables measured by devices, in Scada, reports, charts and tables, it will be necessary to know the encoding used by the software for each of them.

The basic encoding comprises the device name and the variable code separated by a dot.

name.variable

In this way the software will know which variable is involved and which device should be asked for the value of the said variable.

This encoding (variable-name) can be used in formulae, graphs and tables, although in the case of reports, graphs and tables we can display variables saved in value log files.

On those occasions we wish to discriminate a variable, as long as the variable can be discriminated, for instance in the case of energy, the discriminator information will be added to the basic encoding.

name_discriminator @ name_type_time: name.variable

Here the name of the discriminator and the name of the type of hour upon which the variable values will be discriminated are indicated.

This type of encoding with discriminators may only be used in reports, graphs and tables, and with variables that have been saved in value log files.

For a better understanding, the variables are displayed in separate tables depending on the type of variable measured by the devices. The columns on the left correspond to the type of variable measured: whether the variable is instantaneous, maximum or minimum, the phase to which it corresponds, or any other information depending on the variable, and finally the code used (for example the instantaneous phase-neutral voltage of phase 1 will correspond to the code VI1). On the other hand, the columns to the right of each table will correspond to devices that can measure each of the variables, indicating with an ‘X’ if the variable will be measured by the device and with an ‘O’ if the variable will be measured depending on the version of the device.

14.1.1 Voltage

	Phase – neutral voltage											
	Instantaneous				Maximum				Minimums			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	VI1	VI2	VI3	VI	VMX1	VMX2	VMX3	VMX	VMN1	VMN2	VMN3	VMN
CIRWATT	X	X	X									
CVM 144	X	X	X		X	X	X		X	X	X	
CVM 96	X	X	X		X	X	X		X	X	X	
CVM B/BD	X	X	X	X								
CVM BC	X	X	X		X	X	X		X	X	X	
CVM K	X	X	X	X								
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVMK HAR	X	X	X									
CVM MINI	X	X	X		X	X	X		X	X	X	
CVM NRG 96	X	X	X		X	X	X		X	X	X	
CVM SP	X				X				X			
MK LCD	X				X							
POWERNET	X	X	X		X	X	X		X	X	X	
QNA	O	O	O									

	Phase- phase - voltage											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	VI12	VI23	VI31	VI123	VMX12	VMX23	VMX31	VMX123	VMN12	VMN23	VMN31	VMN123
CIRWATT	X	X	X									
CVM 144	X	X	X		X	X	X		X	X	X	
CVM 96	X	X	X		X	X	X		X	X	X	
CVM B/BD	X	X	X	X								
CVM BC	X	X	X		X	X	X		X	X	X	
CVM K	X	X	X	X								
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVMK HAR	X	X	X									
CVM MINI	X	X	X		X	X	X		X	X	X	
CVM NRG 96	X	X	X		X	X	X		X	X	X	
MK LCD	X				X							
POWERNET	X	X	X		X	X	X		X	X	X	
QNA	O	O	O									

	Nominal voltage		
	Instantaneous		
	L1	L2	L3
	VPNOMI1	VPNOMI2	VPNOMI3
QNA	X	X	X

	Neutral voltage		
	Instantaneous	Maximum	Minimum
	VNI	VNMX	VNMN
CVM K2	X		
QNA	O		

	Absolute minimum- voltage					
	All registers			Valid registers		
	L1	L2	L3	L1	L2	L3
	V1MINT	V2MINT	V3MINT	V1MINV	V2MINV	V3MINV
QNA	O	O	O	O	O	O

	Lower percentile [5%] – voltage					
	All registers			Valid registers		
	L1	L2	L3	L1	L2	L3
	V1INFT	V2INFT	V3INFT	V1INFV	V2INFV	V3INFV
QNA	O	O	O	O	O	O

	Higher percentile [95%] –voltage					
	All registers			Valid registers		
	L1	L2	L3	L1	L2	L3
	V1HIGPT	V2HIGPT	V3HIGPT	V1HIGV	V2HIGV	V3HIGV
QNA	O	O	O	O	O	O

	Absolute maximum– Voltage					
	All registers			Valid registers		
	L1	L2	L3	L1	L2	L3
	V1MAXT	V2MAXT	V3MAXT	V1MAXV	V2MAXV	V3MAXV
QNA	O	O	O	O	O	O

	Voltage distortion								
	Instantaneous			Maximum			Minimum		
	L1	L2	L3	L1	L2	L3	L1	L2	L3
	DVI1	DVI2	DVI3	DVMX1	DVMX2	DVMX3	DVMN1	DVMN2	DVMN3
CVM 144	X	X	X	X	X	X	X	X	X
CVM 96	X	X	X	X	X	X	X	X	X
CVM B/BD	O	O	O						
CVM BC	X	X	X	X	X	X	X	X	X
CVM K	O	O	O						
CVM K2	X	X	X						
CVMK HAR	X	X	X						
CVM MINI	X	X	X	X	X	X	X	X	X
CVM NRG 96	X	X	X	X	X	X	X	X	X
CVM SP	X			X			X		
POWERNET	X	X	X	X	X	X	X	X	X
QNA	X	X	X						

	Voltage distortion on neutral		
	Instantaneous	Maximum	Minimum
	DVNI	DVNMX	DVNMN
CVM K2	X		

	Voltage distortion – Higher percentile [95%]							
	All registers				Valid registers			
	L1	L2	L3	III	L1	L2	L3	III
	DV1SUPT	DV2SUPT	DV3SUPT	DVSUPT	DV1SUPV	DV2SUPV	DV3SUPV	DVSUPV
QNA	O	O	O	O	O	O	O	O

14.1.2 Current

	Current											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	AI1	AI2	AI3	AI	AMX1	AMX2	AMX3	AMX	AMN1	AMN2	AMN3	AMN
CIRWATT	X	X	X									
CVM 144	X	X	X		X	X	X		X	X	X	
CVM 96	X	X	X		X	X	X		X	X	X	
CVM B/BD	X	X	X	X								
CVM BC	X	X	X		X	X	X		X	X	X	
CVM K	X	X	X	X								
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVMK HAR	X	X	X									
CVM MINI	X	X	X		X	X	X		X	X	X	
CVM NRG 96	X	X	X		X	X	X		X	X	X	
CVM SP	X				X				X			
MK LCD	X				X							
POWERNET	X	X	X	X	X	X	X	X	X	X	X	X
QNA	O	O	O									

	Neutral current		
	Instantaneous	Maximum	Minimum
	ANI	ANMX	ANMN
CVM 144	O	O	O
CVM 96	O	O	O
CVM B/BD	O		
CVM BC	O	O	O
CVM K	O		
CVM K2	X		
CVM MINI	X	X	X
CVM NRG 96	X	X	X
QNA	O		

	Leakage current		
	Instantaneous	Maximum	Minimum
	AELI	AELMX	AELMN
CVM 144	O	O	O

	Current distortion								
	Instantaneous			Maximum			Minimum		
	L1	L2	L3	L1	L2	L3	L1	L2	L3
	DVI1	DVI2	DVI3	DVMX1	DVMX2	DVMX3	DVMN1	DVMN2	DVMN3
CVM 144	X	X	X	X	X	X	X	X	X
CVM 96	X	X	X	X	X	X	X	X	X
CVM B/BD	O	O	O						
CVM BC	X	X	X	X	X	X	X	X	X
CVM K	O	O	O						
CVM K2	X	X	X						
CVMK HAR	X	X	X						
CVM MINI	X	X	X	X	X	X	X	X	X
CVM NRG 96	X	X	X	X	X	X	X	X	X
CVM SP	X			X			X		
POWERNET	X	X	X	X	X	X	X	X	X
QNA	O	O	O						

	Current distortion on neutral		
	Instantaneous	Maximum	Minimum
	DANI	DANMX	DANMN
CVM K2	X		

14.1.3 Frequency

	Frequency		
	Instantaneous	Maximum	Minimum
	HZI	HZMX	HZMN
CIRWATT	X		
CVM 144	X	X	X
CVM 96	X	X	X
CVM B/BD	X		
CVM BC	X	X	X
CVM K	X		
CVM K2	X	X	X
CVM K HAR	X		
CVM MINI	X	X	X
CVM NRG 96	X	X	X
CVM SP	X	X	X
MK LCD	X	X	
POWERNET	X	X	X
QNA	X		

	Absolute minimum –Frequency	
	All registers	Valid registers
	HZMINT	HZMINV
QNA	O	O

	lower percentile [5%]– Frequency	
	All registers	Valid registers
	HZINFT	HZINFV
QNA	O	O

	Upper percentile [95%] – Frequency	
	All registers	Valid registers
	HZSUPT	HZSUPV
QNA	O	O

	Absolute maximum – Frequency	
	All registers	Valid registers
	HZMAXT	HZMAXV
QNA	O	O

14.1.4 Power

	Apparent power consumed											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	VAI1	VAI2	VAI3	VAI	VAMX1	VAMX2	VAMX3	VAMX	VAMN1	VAMN2	VAMN3	VAMN
CIRWATT	X	X	X	X								
CVM 144	X	X	X	X	X	X	X	X	X	X	X	X
CVM 96	X	X	X	X	X	X	X	X	X	X	X	X
CVM B/BD	X	X	X	X								
CVM BC	X	X	X	X	X	X	X	X	X	X	X	X
CVM K	X	X	X	X								
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM MINI	X	X	X	X	X	X	X	X	X	X	X	X
CVM NRG 96	X	X	X	X	X	X	X	X	X	X	X	X
CVM SP	X				X				X			
POWERNET				X				X				X
QNA				O								

	Apparent power generated											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	NVAI1	NVAI2	NVAI3	NVAI	NVAMX1	NVAMX2	NVAMX3	NVAMX	NVAMN1	NVAMN2	NVAMN3	NVAMN
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM MINI	X	X	X	X	X	X	X	X	X	X	X	X
CVM NRG 96	X	X	X	X	X	X	X	X	X	X	X	X
QNA				O								

	Active power Consumed											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	API1	API2	API3	API	APMX1	APMX2	APMX3	APMX	APMN1	APMN2	APMN3	APMN
CIRWATT	X	X	X	X								
CVM 144	X	X	X	X	X	X	X	X	X	X	X	X
CVM 96	X	X	X	X	X	X	X	X	X	X	X	X
CVM B/BD	X	X	X	X								
CVM BC	X	X	X	X	X	X	X	X	X	X	X	X
CVM K	X	X	X	X								
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM MINI	X	X	X	X	X	X	X	X	X	X	X	X
CVM NRG 96	X	X	X	X	X	X	X	X	X	X	X	X
CVM SP	X				X				X			
MK LCD	X				X							
POWERNET	X	X	X	X	X	X	X	X	X	X	X	X
QNA	O	O	O									

	Active power generated											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	NAPI1	NAPI2	NAPI3	NAPI	NAPMX1	NAPMX2	NAPMX3	NAPMX	NAPMN1	NAPMN2	NAPMN3	NAPMN
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM MINI	X	X	X	X	X	X	X	X	X	X	X	X
CVM NRG 96	X	X	X	X	X	X	X	X	X	X	X	X
QNA	O	O	O									

	Capacitive power consumed											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	CPI1	CPI2	CPI3	CPI	CPMX1	CPMX2	CPMX3	CPMX	CPMN1	CPMN2	CPMN3	CPMN
CIRWATT	X	X	X	X								
CVM 144	X	X	X	X	X	X	X	X	X	X	X	X
CVM 96	X	X	X	X	X	X	X	X	X	X	X	X
CVM B/BD	X	X	X	X								
CVM BC	X	X	X	X	X	X	X	X	X	X	X	X
CVM K	X	X	X	X								
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM MINI	X	X	X	X	X	X	X	X	X	X	X	X
CVM NRG 96	X	X	X	X	X	X	X	X	X	X	X	X
CVM SP	X				X				X			
POWERNET	X	X	X	X	X	X	X	X	X	X	X	X

QNA	O	O	O									

	Capacitive power generated											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	NCPI1	NCPI2	NCPI3	NCPI	NCPMX1	NCPMX2	NCPMX3	NCPMX	NCPMN1	NCPMN2	NCPMN3	NCPMN
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM MINI	X	X	X	X	X	X	X	X	X	X	X	X
CVM NRG 96	X	X	X	X	X	X	X	X	X	X	X	X
QNA	O	O	O									

	Inductive Power consumed											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	IPI1	IPI2	IPI3	IPI	IPMX1	IPMX2	IPMX3	IPMX	IPMN1	IPMN2	IPMN3	IPMN
CIRWATT	X	X	X	X								
CVM 144	X	X	X	X	X	X	X	X	X	X	X	X
CVM 96	X	X	X	X	X	X	X	X	X	X	X	X
CVM B/BD	X	X	X	X								
CVM BC	X	X	X	X	X	X	X	X	X	X	X	X
CVM K	X	X	X	X								
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM MINI	X	X	X	X	X	X	X	X	X	X	X	X
CVM NRG 96	X	X	X	X	X	X	X	X	X	X	X	X
CVM SP	X				X				X			
POWERNET	X	X	X	X	X	X	X	X	X	X	X	X
QNA	O	O	O									

	Inductive power generated											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	NIPI1	NIPI2	NIPI3	NIPI	NIPMX1	NIPMX2	NIPMX3	NIPMX	NIPMN1	NIPMN2	NIPMN3	NIPMN
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM MINI	X	X	X	X	X	X	X	X	X	X	X	X
CVM NRG 96	X	X	X	X	X	X	X	X	X	X	X	X
QNA	O	O	O									

	Power factor consumed											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	PFI1	PFI2	PFI3	PFI	PFMX1	PFMX2	PFMX3	PFMX	PFMN1	PFMN2	PFMN3	PFMN
CIRWATT	X	X	X									
CVM 144	X	X	X	X	X	X	X	X	X	X	X	X
CVM 96	X	X	X	X	X	X	X	X	X	X	X	X
CVM B/BD	X	X	X	X								
CVM BC	X	X	X	X	X	X	X	X	X	X	X	X
CVM K	X	X	X	X								
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM MINI	X	X	X	X	X	X	X	X	X	X	X	X
CVM NRG 96	X	X	X	X	X	X	X	X	X	X	X	X
CVM SP	X				X				X			
POWERNET	X	X	X	X	X	X	X	X	X	X	X	X
QNA	O	O	O									

	Power factor generated											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	NPFI1	NPFI2	NPFI3	NPFI	NPFMX1	NPFMX2	NPFMX3	NPFMX	NPFMN1	NPFMN2	NPFMN3	NPFMN
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM MINI	X	X	X	X	X	X	X	X	X	X	X	X
CVM NRG 96	X	X	X	X	X	X	X	X	X	X	X	X
QNA	O	O	O									

	Cos φ consumed											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	COSI1	COSI2	COSI3	COSI	COSMX1	COSMX2	COSMX3	COSMX	COSMN1	COSMN2	COSMN3	COSMN
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM MINI				X				X				X
CVM NRG 96				X				X				X

	Cos φ generated											
	Instantaneous				Maximum				Minimum			
	L1	L2	L3	III	L1	L2	L3	III	L1	L2	L3	III
	NCOSI1	NCOSI2	NCOSI3	NCOSI	NCOSMX1	NCOSMX2	NCOSMX3	NCOSMX	NCOSMN1	NCOSMN2	NCOSMN3	NCOSMN
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM MINI				X				X				X
CVM NRG 96				X				X				X

14.1.5 Energies

	Apparent energy			
	Consumed		Generated	
	III	Tariff y (y:1..9)	III	Tariff y (y:1..9)
	VAE	VAETy	NVAE	NVAETy
CVM K2	X	O	X	O
CVM MINI	X		X	
CVM NRG 96	X		X	

	Active energy Consumed								
	L1	L2	L3	III	Partial	Tariff y		Contract x (x:1..3)	
						y:1..3	y:4..9	Tariff y (y:1..9)	Total
	AE1	AE2	AE3	AE	PAE	AETy	AETy	AECxTy	AECxTOT
CIRWATT	X	X	X	X				X	X
CVM 144				X					
CVM 96				X					
CVM B/BD				X		O			
CVM BC				X					
CVM K				O		O			
CVM K2				X		O	O		
CVM MINI				X					
CVM NRG 96				X					
CVM SP				X					
EDMK				X	O				
MK D				X	O	O			
MK LCD				X	X				
POWERNET				X					
QNA				O					

	Active energy generated								
	L1	L2	L3	III	Partial	Tariff		Contract x (x:1..3)	
						y:1..3	y:4..9	Tariff y (y:1..9)	Total
	NAE1	NAE2	NAE3	NAE	NPAE	NAETy	NAETy	NAECxTy	NAECxTOT
CIRWATT	X	X	X	X				X	X
CVM B/BD				O		O			
CVM K				O		O			
CVM K2				X		O	O		
CVM MINI				X					
CVM NRG 96				X					
EDMK				O	O				
MK D				O	O	O			
QNA				O					

	Capacitive energy consumed									
	III	Partial	Tariff		2nd quadrant (2Q)					
					L1	L2	L3	III	Contract x (x:1..3)	
			y:1..3	y:4..9					Tariff y (y:1..9)	Total
	CE	PCE	CETy	CETy	CE2Q1	CE2Q2	CE2Q3	CE2Q	CE2QCxTy	CE2QCxTOT
CIRWATT					X	X	X	X	X	X
CVM 144	X									
CVM 96	X									
CVM B/BD	X		O							
CVM BC	X									
CVM K	O		O							
CVM K2	X		O	O						
CVM MINI	X									
CVM NRG 96	X									
CVM SP	X									
EDMK	X	O								
MK D	X	O	O							
POWERNET	X									
QNA	O									

	Capacitive energy generated									
	III	Partial	Tariff		2nd quadrant (4Q)					
					L1	L2	L3	III	Contract x (x:1..3)	
			y:1..3	y:4..9					Tariff y (y:1..9)	Total
	NCE	PNCE	NCETy	NCETy	CE4Q1	CE4Q2	CE4Q3	CE4Q	CE4QCxTy	CE4QCxTOT
CIRWATT					X	X	X	X	X	X
CVM B/BD	X		O							
CVM BC	X									
CVM K	O		O							
CVM K2	X		O	O						
CVM MINI	X									
CVM NRG 96	X									
EDMK	O	O								
MK D	O	O	O							
QNA	O									

	Inductive energy consumed									
	III	Partial	Tariff		1^{st} quadrant (1Q)					
					L1	L2	L3	III	Contract x (x:1..3)	
			y:1..3	y:4..9					Tariff y (y:1..9)	Total
	IE	PIE	IETy	IETy	IE1Q1	IE1Q2	IE1Q3	IE1Q	IE1QCxTy	IE1QCxTOT
CIRWATT					X	X	X	X	X	X
CVM 144	X									
CVM 96	X									
CVM B/BD	X		O							
CVM BC	X									
CVM K	O		O							
CVM K2	X		O	O						
CVM MINI	X									
CVM NRG 96	X									
CVM SP	X									
EDMK	X	O								
MK D	X	O	O							
POWERNET	X									
QNA	O									

	Inductive energy generated									
	III	Partial	Tariff		3rd quadrant (3Q)					
					L1	L2	L3	III	Contract x (x:1..3)	
			y:1..3	y:4..9					Tariff y (y:1..9)	Total
	NIE	PNIE	NIETy	NIETy	IE3Q1	IE3Q2	IE3Q3	IE3Q	IE3QCxTy	IE3QCxTOT
CIRWATT					X	X	X	X	X	X
CVM B/BD	X		O							
CVM BC	X									
CVM K	O		O							
CVM K2	X		O	O						
CVM MINI	X									
CVM NRG 96	X									
EDMK	O	O								
MK D	O	O	O							
QNA	O									

All energy variables can be discriminated.

14.1.6 Maximum demand

	Maximum demand consumed									
	Instantaneous					Maximum				
	L1	L2	L3	III	Tariff y (y:1..3)	L1	L2	L3	III	Tariff y (y:1..3)
	MDI1	MDI2	MDI3	MDI	MDITy	MDMX1	MDMX2	MDMX3	MDMX	MDMXTy
CVM 144	O	O	O	O		O	O	O	O	
CVM 96	O	O	O	O		O	O	O	O	
CVM B/BD					O					O
CVM BC	O	O	O	O		O	O	O	O	
CVM K					O					O
CVM MINI	O	O	O	O		O	O	O	O	
CVM NRG 96	O	O	O	O		O	O	O	O	
CVM SP	O					O				
POWERNET	O	O	O	O		O	O	O	O	

	Maximum demand generated									
	Instantaneous					Maximum				
	L1	L2	L3	III	Tariff y (y:1..3)	L1	L2	L3	III	Tariff y (y:1..3)
	NMDI 1	NMDI 2	NMDI 3	NMDI	NMDITy	NMDMX1	NMDMX2	NMDMX3	NMDMX	NMDMXTy
CVM NRG 96	O	O	O	O		O	O	O	O	

	Maximum demand of apparent power							
	Consumed				Generated			
	Instantaneous		Maximum		Instantaneous		Maximum	
	MDVAI	Tariff y (y:1..9)	MDVAMX	Tariff y (y:1..9)	NMDVAI	Tariff y (y:1..9)	NMDVAMX	Tariff y (y:1..9)
		MDVAITy		MDVAMXTy		NMDVAITy		NMDVAMXTy
CVM K2	X	O	X	O	X	O	X	O

	Maximum demand of active power							
	Consumed				Generated			
	Instantaneous		Maximum		Instantaneous		Maximum	
	MDAPI	Tariff y (y:1..9)	MDAPMX	Tariff y (y:1..9)	NMDAPI	Tariff y (y:1..9)	NMDAPMX	Tariff y (y:1..9)
		MDAPITy		MDAPMXTy		NMDAPITy		NMDAPMXTy
CVM K2	X	O	X	O	X	O	X	O

	Maximum current demand							
	Instantaneous				Maximum			
	L1	L2	L3	III	L1	L2	L3	III
	MDAI1	MDAI2	MDAI3	MDAI	MDAMX1	MDAMX2	MDAMX3	MDAMX
CVM K2	X	X	X	X	X	X	X	X

	Maximum current demand Tariff y (y:1..9)							
	Instantaneous				Maximum			
	L1	L2	L3	III	L1	L2	L3	III
	MDAI1Ty	MDAI2Ty	MDAI3Ty	MDAITy	MDAMX1Ty	MDAMX2Ty	MDAMX3Ty	MDAMXTy
CVM K2	O	O	O	O	O	O	O	O

All maximum demand variables can be discriminated.

14.1.7 Harmonics

	Voltage harmonics							
	L1		L2		L3		Neutral	
	x:1..15	x:16..50	x:1..15	x:16..50	x:1..15	x:16..50	x:1..15	x:16..50
	ARMxV1		ARMxV2		ARMxV3		ARMxVN	
CVM K2	X	X	X	X	X	X	X	X
CVM K HAR	X	X	X	X	X	X		
CVM MINI	X		X		X			
CVM NRG 96	X		X		X			
QNA	O	O	O	O	O	O		

	Current harmonics											
	L1			L2			L3			Neutral		
	x:1..15	x:16..31	x:32..50	x:1..15	x:16..31	x:32..50	x:1..15	x:16..31	x:32..50	x:1..15	x:16..31	x:32..50
	ARMxA1			ARMxA2			ARMxA3			ARMxAN		
CVM 144	O			O			O					
CVM 96	O	O		O	O		O	O				
CVM K2	X	X	X	X	X	X	X	X	X	X	X	X
CVM K HAR	X	X	X	X	X	X	X	X	X			
CVM MINI	X			X			X					
CVM NRG 96	X			X			X					
QNA	O	O	O	O	O	O	O	O	O			

	Maximum voltage harmonics (3 sec.)		
	L1	L2	L3
	ARMyMXCV1 (y:1..50)	ARMyMXCV2 (y:1..50)	ARMyMXCV3 (y:1..50)
QNA	O	O	O

	Maximum voltage harmonics (10 mins.)		
	L1	L2	L3
	ARMyMXPV1 (y:1..50)	ARMyMXPV2 (y:1..50)	ARMyMXPV3 (y:1..50)
QNA	O	O	O

14.1.8 Pst / Plt

	Pst		
	L1	L2	L3
	PST1	PST2	PST3
CVM K2	O	O	O
QNA	O	O	O

	Pst – Upper percentile [95%]					
	All registers			Valid registers		
	L1	L2	L3	L1	L2	L3
	PST1SUPT	PST2SUPT	PST3SUPT	PST1SUPV	PST2SUPV	PST3SUPV
QNA	O	O	O	O	O	O

	Pst – Input x (x:1..20)		
	L1	L2	L3
	PST1DIx	PST2DIx	PST3DIx
QNA	O	O	O

	Plt		
	L1	L2	L3
	PLT1	PLT2	PLT3
CVM K2	O	O	O
QNA	O	O	O

	Plt – Upper percentile [95%]					
	All registers			Valid registers		
	L1	L2	L3	L1	L2	L3
	PLT1SUPT	PLT2SUPT	PLT3SUPT	PLT1SUPV	PLT2SUPV	PLT3SUPV
QNA	O	O	O	O	O	O

14.1.9 Inputs and outputs

	Digital inputs			
	x:1..4	x:4..18	x:19..24	x:25..50
	DIx			
CVM 144	O			
CVM K2	O	O	O	
CVM R8	O	O		
LM 24	X	X	X	
LM50	X	X	X	X
TCP50 ALARM	X	X	X	X

	Analogue inputs											
	Instantaneous				Maximum				Minimum			
	x:1..1	x:2..3	x:4..8	x:9..24	x:1..1	x:2..3	x:4..8	x:9..24	x:1..1	x:2..3	x:4..8	x:9..24
	AIIx				AIMXx				AIMNx			
CVM 144	O	O			O	O			O	O		
CVM K2	O	O	O	O								
CVM R8	O	O	O		O	O	O		O	O	O	
CVM MINI	X				X				X			

The analogue input of the CVM-MINI devices will correspond to the temperature variable measured by this type of device.

	Digital outputs:						
	1	2	3	4	x:5..18	x:19..20	x:21..24
	DO1	DO2	DO3	DO4	DOx		
CIRWATT	X	X	X	X			
CVM 144	O	O					
CVM 96	O	O					
CVM BC	O	O					
CVM K2	O	O	O	O	O	O	O
CVM R8	O	O	O	O	O		
CVM MINI	X	X					
CVM NRG96	X						
CVM SP	O	O					
EDMK	O	O					
MK LCD	X						
QNA	O	O	O	O	O	O	

Digital outputs may be forced to 0 (the output will remain open) or to 1 (the output will remain closed).

14.1.10 Counters

	Counter	
	x:1..24	x:25..50
	Cx	
CVM K2	O	
LM 24	X	
LM50	X	X

The values of the counters on the LM50 devices may be forced between 0 and the maximum value permitted by the device. See the device manual for more details on this maximum value.

All counter variables can be discriminated.

14.1.11 Special device variables

14.1.11.1 C-14d

	Current	Current distortion	Cos φ	Active Quadrant	Alarm active	Digital output	
						Alarm	x:1..14
	AI	DAI	COSI	QUADRANT	ALARM	DO0	DOx
C-14d	X	X	X	X	X	X	X

Active Quadrant	*Value*
Energy consumed	0
Energy consumed. Capacitive system	1
Energy consumed .Inductive system	2
Energy generated	4
Energy generated .Capacitive system	5
Energy generated .Inductive system	6

Alarm active	*Value*
None	0
Compensation alarm (-CE)	1
Overcurrent alarm (-AE)	2
Distortion alarm (-dE)	3
Setup error alarm	4
Expansion card communication alarm	5
Referenced voltage error alarm	6

Alarm digital output	*Value*
Not enabled	0
Enabled	1

14.1.11.2 CBS-4

	Earth leakage current		Status		
	Instantaneous	Detected	of the channel	Of the protection	Alarm relay
	Channel x (x:1..4)				
	AELIx	AELDx	STx	DOx	DO0
CBS-4	X	X	X	X	X

Channel status:	*Value*
Not Triggered.	0
Earth leakage current exceeded	1
Toroid error	2

Protection status:	*Value*
Not enabled	0
Enabled	1

Pre-alarm relay status	*Value*
Not enabled	0
Enabled	1

On CBS-4 devices we can reset the x channel forcing the status variable of the RSTx to value 0 or remotely trigger the channel forcing the variable to 1.

14.1.11.3 CBS-8, CDR-8

	Earth leakage current		Status		
	Instantaneous	Detected	Of the output	Pre-alarm relay	Pre-alarm relay
	Channel x (x:1..8)				
	AELIx	AELDx	STx	DOx	DO0
CBS-8	X	X	X	X	X
CDR-8	X	X	X	X	X

Status of the channel output	*Value*
Not Triggered.	0
Earth leakage current exceeded	1
Output triggered	2
Output latched	3

Pre-alarm relay status	*Value*
Not enabled	0
Enabled	1

On CBS-8 and CDR-8 devices we can reset the x channel forcing the status variable of the (STx) to value 16

We can also remotely trigger the x channel forcing the RFCx variable to 1 to activate remote triggering or 0 to deactivate it.

14.1.11.4 CIRWATT

The following shows the specific variables of the CIRWATT devices, the shared variables, such as voltage and current, are included in the corresponding variable table.

	Billing closures- absolute energy					
	Contract x (x:1.) 1..3)					
	Tariff y (y:1..9)			Total		
	Active	Inductive	Capacitive	Active	Inductive	Capacitive
	AEABSCxTy	IEABSCxTy	CEABSCxTy	AEABSCxTOT	IEABSCxTOT	CEABSCxTOT
CIRWATT	X	X	X	X	X	X

	Billing closures– Incremental energy					
	Contract x (x:1.) 1..3)					
	Tariff y (y:1..9)			Total		
	Active	Inductive	Capacitive	Active	Inductive	Capacitive
	AEINCCxTy	IEINCCxTy	CEINCCxTy	AEINCCxTOT	IEINCCxTOT	CEINCCxTOT
CIRWATT	X	X	X	X	X	X

	Billing closures - Power					
	Contract x (x:1.) 1..3)					
	Tariff y (y:1..9)			Total		
	Maximum demand	Power excesses	Power factor	Maximum demand	Power excesses	Power factor
	MDCxTy	EXCCxTy	PFCxTy	MDCxTOT	EXCCxTOT	FPCxTOT
CIRWATT	X	X	X	X	X	X

The power factor variable is calculated by the software using active and inductive energy.

	Power	
	Contract x (x:1.) 1..3) Tariff and (y: 1..9)	
	Contracted	Excesses by register
	CPWCxTy	REXCCxTy
CIRWATT	X	X

Power Excesses are calculated by the software for each curve register downloaded onto CIRWATT equipment

14.1.11.5 CVM-K2

The following shows the specific variables of the CVM-K2 devices, the shared variables, such as voltage and current, are included in the corresponding variable table.

	Coefficient K_d					
	Voltage:			Current		
	Instantaneous:	Maximum	Minimum	Instantaneous:	Maximum	Minimum
	KDVI	KDVMX	KDVMN	KDAI	KDAMX	KDAMN
CVM K2	X			X		

	Coefficient K_a					
	Voltage:			Current		
	Instantaneous:	Maximum	Minimum	Instantaneous:	Maximum	Minimum
	KAVI	KAVMX	KAVMN	KAAI	KAAMX	KAAMN
CVM K2	X			X		

	Temperature		
	Instantaneous	Maximum	Minimum
	TI	TMX	TMN
CVM K2	X	X	X

	Factor K								
	Instantaneous			Maximum			Minimum		
	L1	L2	L3	L1	L2	L3	L1	L2	L3
	KFAI1	KFAI2	KFAI3	KFAMX1	KFAMX2	KFAMX3	KFAMN1	KFAMN2	KFAMN3
CVM K2	X	X	X	X	X	X	X	X	X

	Crest factor								
	Instantaneous			Maximum			Minimum		
	L1	L2	L3	L1	L2	L3	L1	L2	L3
	CFVI1	CFVI2	CFVI3	CFVMX1	CFVMX2	CFVMX3	CFVMN1	CFVMN2	CFVMN3
CVM K2	X	X	X	X	X	X	X	X	X

	Weighted Flicker		
	L1	L2	L3
	FWA1	FWA2	FWA3
CVM K2	X	X	X

14.1.11.6 DH-96

	Voltage:			Current			Active power			Active energy
	Inst.	Max.	MIN	Inst.	Max.	MIN	Inst.	Max.	MIN	
	VI	VMX	VMN	AI	AMX	AMN	API	APMX	APMN	AE
DH-96 CPM	X	X	X	X	X	X	X	X	X	X

	Measured	Peak	Off-peak	Counter	Flow
	ME	PK	VL	C1	F1
DH-96 AC	X	X	X		
DH-96 CT				X	O
DH-96 DC	X	X	X		
DH-96 FT	X	X	X		
DH-96 SG	X	X	X		
DH-96 TMP	X	X	X		
DH-96 WG	X	X	X		

14.1.11.7 MK D

	Active tariff	Digital input		Counters		Digital output	
	ACTTARIFF	DI1	DI2	C1	C2	DO1	DO2
MK D	O	O	O	O	O	O	O

14.1.11.8 QNA

The following shows the specific variables of the QNA devices, the shared variables, such as voltage and current, have been included in the corresponding variable table.

	Event alarms								
	Power cut			Gap			Overvoltage		
	L1	L2	L3	L1	L2	L3	L1	L2	L3
	ALEVEI1	ALEVEI2	ALEVEI3	ALEVES1	ALEVES2	ALEVES3	ALEVEO1	ALEVEO2	ALEVEO3
QNA	X	X	X	X	X	X	X	X	X

Alarm event variables will activate (value 1) when an event is produced in the QNA and will remain active for 5 seconds. When these 5 seconds have elapsed without any new event taking place, the alarm will deactivate (value 0).

	Voltage phasor		Voltage-current phasor		
	L1-L2	L1-L3	L1	L2	L3
	FDV12	FDV13	FDVI1	FDVI2	FDVI3
QNA	O	O	O	O	O

	Counter of number of 10 cycle blocks					
	With EVQ			With voltage off limits		
	L1	L2	L3	L1	L2	L3
	STCBE1	STCBE2	STCBE3	STCVB1	STCVB2	STCVB3
QNA	X	X	X	X	X	X

	Counter of 150 cycle integrations					
	Of all STD parameters except voltage			Voltage		
	L1	L2	L3	L1	L2	L3
	STCIS1	STCIS2	STCIS3	STCIV1	STCIV2	STCIV3
QNA	X	X	X	X	X	X

	Coefficient K_d		Coefficient K_a	
	Voltage:	Current	Voltage:	Current
	KDV	KDA	KAV	KAA
QNA	O	O	O	O

	Imbalance-percentile higher than 95%	
	All registers	Valid registers
	UBSUPT	UBSUPV
QNA	O	O

	Total no. of registers	Registers without events	Value counters					
			Frequency	Frequency without events	Plt	Plt without events		
						L1	L2	L3
	NREGTOT	NREGEVQ	CVHZ	CVHZEVQ	CVPLT	CVPLT1EVQ	CVPLT2EVQ	CVPLT3EVQ
QNA	O	O	O	O	O	O	O	O

	Event log		
	L1	L2	L3
	HEVQ1	HEVQ2	HEVQ3
QNA	X	X	X

14.1.11.9 RGU-10 / RGU-10 RA

	Efficient value		Status			
	Leakage current	Leakage current trigger	Pre-alarm trigger	Latching	Coil triggering	Device
	AELI	AELD	DO0		DO1	ST
RGU-10	X	X	X		X	
RGU-10 RA	X	X		X		X

	No. of reclosures			
	Earth leakage		Circuit breaker	
	Partial	Total	Partial	Total
	RCPD	RCTD	RCPM	RCTM
RGU-10 RA	X	X	X	X

Pre-alarm trigger output status	*Value*
Not enabled	0
Enabled	1

Latching output status	*Value*
Not latched	0
Latched	1

Coil trigger output status	*Value*
Not Tripped.	0
Tripped	1

Status of the device .	*Value*
Start	0
Rest	1
Earth leakage trigger latching	2
Earth leakage trigger waiting	3
Circuit breaking trigger latching	4
Circuit breaking trigger waiting	5
Toroid disconnected	6
External input enabled	7
Remote trigger	8
Test trigger	9
Manufacturing mode	10
Calibration mode	11

To carry out a channel reset on the RGU-10 devices the RST variable must be forced to value 0.

To carry out a remote triggering of the channel the RST variable should be forced to the value 1.

14.1.11.10RRM-C

	Reclosure counter	No. of selected reclosures	Time between reclosures.	Status of the device .
	RC	RN	RT	ST
RRM-C	X	X	X	X

Status of the device .	*Value*
Unknown	65535
Connected	0
Latched	1
External trigger	2
Residual current device trigger	4
Communication trigger	8
External and communication trigger	10

On RRM-C devices the status of the devices can be forced to 16 to reset it or 17 for the external device trigger.

14.1.12 Graph variables and special tables

Special variables for graphs and tables serve to indicate to PowerStudio that we want to make a graph or non-standard table. On a non-standard graph or table the values that appear in the X and Y axis, rows and columns on a table, may switch from one type to another, depending on the variables represented. For a better understanding of these graphs and tables see the section on the java client.

When you want to make special graphs or tables, such as the waveform or harmonics, it will be necessary to use the following variables.

	Waveform					
	Voltage:			Current		
	L1	L2	L3	L1	L2	L3
	FOV1	FOV2	FOV3	FOA1	FOA2	FOA3
QNA	O	O	O	O	O	O

	Harmonics							
	Voltage:				Current			
	L1	L2	L3	Neutral	L1	L2	L3	Neutral
	ARMV1	ARMV2	ARMV3	ARMVN	ARMA1	ARMA2	ARMA3	ARMVN
CVM 144					O	O	O	
CVM 96					O	O	O	
CVM K2	X	X	X	X	X	X	X	X
CVM K HAR	X	X	X		X	X	X	
CVM MINI	X	X	X		X	X	X	
CVM NRG 96	X	X	X		X	X	X	
QNA	O	O	O		O	O	O	

	Maximum voltage harmonics (3 sec.)		
	L1	L2	L3
	ARMMXCV1	ARMMXCV2	ARMMXCV3
QNA	O	O	O

	Maximum voltage harmonics (10 mins.)		
	L1	L2	L3
	ARMMXPV1	ARMMXPV2	ARMMXPV3
QNA	O	O	O

	Events					
	Duration			effective semi-circle voltage		
	L1	L2	L3	L1	L2	L3
	DEVQ1	DEVQ2	DEVQ3	VEVQ1	VEVQ2	VEVQ3
QNA	X	X	X	X	X	X

	Billing closures
	TCLW
CIRWATT	X

14.1.13 Status of devices

Sometimes it will be necessary to know the status of a device, for example when you want to activate an event when a device stops communicating. To ascertain the status we use the STATUS variable.

name. STATUS

The following are the possible values that this status variable may have.

Status of the device.	*Value*
The device is working properly.	1
Device not initialised, initial communication with the device has not been established.	4
The communication port is incorrect or nonexistent.	18
Communication errors with the device are produced.	34
The type of device you are trying to communicate with is different to the specified device.	66
The device communicates correctly, but it detects that some of the phases are badly connected.	130
The version of the device is incompatible with the software.	258
The SD Memory Card is invalid, write-protected or not present.	514

14.1.14 Event Variables

The event variables will be coded for use in formulas and expressions such as

R$EVE_variable. name

Using the R$EVE prefix the program will ascertain that this is an event variable rather than a device variable.

The following is a table with the different variables associated with each event

Identifier	*Description*
ST	State of the event (0 off, 1: Enabled)
TACT	Time the event has been active, the value is 0 when the event is disabled
CACT [1]	Counter of the number of activations
CDIS [1]	Counter of the number of deactivation
CACK [1] [2]	Counter of the number of acknowledgments
CTIM [1]	% Of consultation period time that the incident is enabled

[1] Only if the event is saved on file
[2] Only if the incident is reported

14.2 Expressions and conditions

Many parts of the program allow the inclusion of terms or conditions. To enter these there is a standard text control available accompanied by a help button that will guide you through editing them.

Thus, some valid examples would be:

```
2*(4.56^2)
1-(2.12-4)/2
```

The following mathematical functions can also be used:

sqrt (exp): Square root of the expression "*exp*
log (exp): Neperian logarithm of the expression "*exp*
Exp (exp): Number "e" elevated to the expression "*exp*
sin (exp): Sine of the expression "*exp*" (in radiants)
Cos (exp): Cosine of the expression "*exp*" (in radiants)
tan (exp): Tangent of the expression "*exp*" (in radiants)
asin (exp): Arcsine of the expression "exp" (in radiants)
Acos (exp): Arccosine of the expression "*exp*" (in radiants)
atan (exp): Arctangent of the term "*exp*
atan2 (exp1, exp2): Extended arctangent of the expression "*exp1/exp2*"
log10(exp): Base 10 logarithm of the expression "*exp*
round (exp): Rounding off to whole number nearest to the expression "*exp*
trunc (exp): Truncation to the whole number of the expression "*exp*
pi() : Returns the number IP (3.1415927…).
e() : Returns the number E (2.7182818…).
mod (exp1, exp2): Return the module "exp2" of the expression "exp1
max (exp1, exp2): Returns the maximum of the two expressions
min (exp1, exp2): Return the minimum of the two expressions
abs(exp): Returns the absolute value of the expression "*exp*
rand(): Returns a real random value between 0.0 and 1.0
if(cond, exp1, exp2): Evaluates the condition "*cond*". If the condition is true it returns the expression "*exp1*" if false it returns the expression "*exp2*

We should remember some details about these functions. The square root function will return an error if the expression is negative. The logarithmic functions ("***log***" and "***log10***")will return and error if the expression is less than or equal to zero. The Arctangent function ("***atan***") assesses a range that goes from -π/2 to π/2 and returns zero if the expression is zero. The extended Arctangent function ("***atan2***") assesses a range that goes from –π to π and returns zero if both expressions are zero. The Arcsine functions ("***asin***"), Arccosine ("***acos***"), Arctangent ("***atan***") and extended Arctangent ("***atan2***") return the result in radiants. The functions that return the number pi ("***pi***") and e ("***e***") have no parameters, so they can be used with or without parentheses. The functions are not case sensitive. Examples of valid formulas are:

```
2*pi()-sqrt(10)
round(exp(2)+atan2(1,2)-e*pi)
```

It is also possible to use certain time functions:

second() : Returns the second of the current date.
minute() : Returns the minute of the current date.
hour() : Returns the hour of the current date.
day() : Returns the day of the current date.
month (): Returns the month of the current date.
Year (): Return the year of the current date.

These functions return values on the date in the local time of the engine and server (editor). As they do not contain parameters they can be used with or without brackets. The "***second***" returns a value between 0 and 59, like the "***minute***" function. The "***hour***" function returns a value between 0 and 23. The "***day***" functions returns a value between 1 and 31. The "***month***" function returns a value between 1 and 12.

The following time functions are available only in reports.

secondsinperiod (): Returns the number of seconds in the current period of the report
minutesinperiod (): Returns the number of minutes in the current period of the report
hoursinperiod (): Returns the number of hours in the current period of the report
daysinperiod (): Returns the number of days in the current period of the report
beginsecond (): Returns the initial second in the actual period of the current report
beginminute (): Returns the initial minute in the current period of the report
beginhour (): Returns the initial hour in the current period of the report
beginday (): Returns the initial day in the actual period of the report
beginmonth (): Returns the initial month in the current period of the report
beginyear (): Returns the initial year in the current period of the report
endsecond (): Returns the final second in the current period of the report
endminute (): Returns the final minute in the current period of the report
endhour (): Returns the final hour in the current period of the report
endday (): Returns the final day in the current period of the report
endmonth (): Returns the final month in the current period of the report
endyear (): Returns the final year in the current period of the report

Both for the expressions and the conditions reference can be made to device variables added to the system. To make reference to one of these variables its name must be entered between the square brackets ("**[**" and "**]**"). The name of a device consists of two parts separated by a period ("**.**") the left side is the name of the device and the right part is the variable code of the device (to consult variable codes allowed consult the corresponding appendix for each device)**.** Some examples are:

```
2*[CVM144.VI1]
[CVM K 1.AE]+[CVM K 2.AE]+[CVM K 3.AE]
```

In some parts of the program it is possible to apply a discriminator to the variable that is, to see the value of said discriminated variable in accordance with a calendar. This is possible, for example, in reports or graphs and only in some specific variables, such energy variables.

In order to refer to the discrimination of a variable we should indicate to the left of the variable, the name of discriminator plus the extension. XDCT "followed by" @ "and the type of hour we want to access. For example, if we have defined a discriminator with the name "Tariff" that contains two types of hours "*H1* and *H2*," we can refer to both as follows:

```
[Tarifa.XDCT@H1:CVMK.AE]
[Tarifa.XDCT@H2:CVMK.AE]
```

It should be emphasized that after the name of the tariff we should always find the "**. XDCT**," extensions followed by "@", the name of the type of hour and the symbol "**:**". Remember that not all variables of the devices can be discriminated against; see the variables code appendix for details on which variables of each device can be discriminated.

In some parts of the programme, such as in the reports and the SCADA screens, we can also refer to variables previously defined in the formula list. Both in the reports and in the SCADA screens we have a list of expressions each identified by a text that, can be used in controlling formulas or in the conditional control. So, if we have defined an expression and we have given the identifier "*F1*", we can use it in other expressions:

```
F1*2.0-1.3
1-sqrt (F1)
```

It should be emphasized that the identifier of an expression (name of the variable) can not start with a numerical digit, although they may be contained in it.

Finally, in those places where a condition is required, it will be possible to use the operators less than ("**<**"), greater than ("**>**"), less than or equal to ("**<=**"), greater than or equal to ("**>=**"), equal to ("**==**"), different to ("**!=**"), logical "Y" ("**&&**"), logical "O" ("**||**") and logical "NO" ("**!**").

Remember that the comparison operators require the terms to the left and right be of the numerical kind while the logical operators require expressions to be conditions. Thus, examples of correct conditions would include:

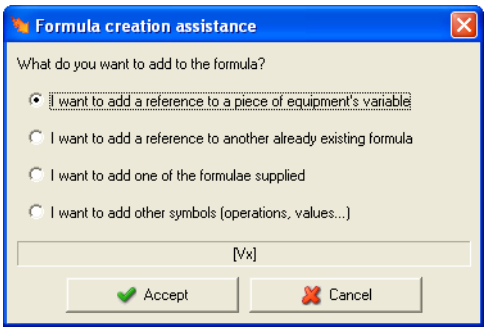
```
[CVMK.VI1]>(240-F1)
(F1!=10 && [CVMK.VI3]<=20)
```

Expressions and variables are always of the numerical type (real) while the conditions are the Boolean type.

14.2.1 Wizard for the Creation of Expressions and Conditions

PowerStudio has an assistant, or wizard, for creating conditions and expressions. This wizard can be accessed by Clicking the button, which is next to the text controls where we can manually enter the terms and conditions.

Clicking on this button will bring up the following window:

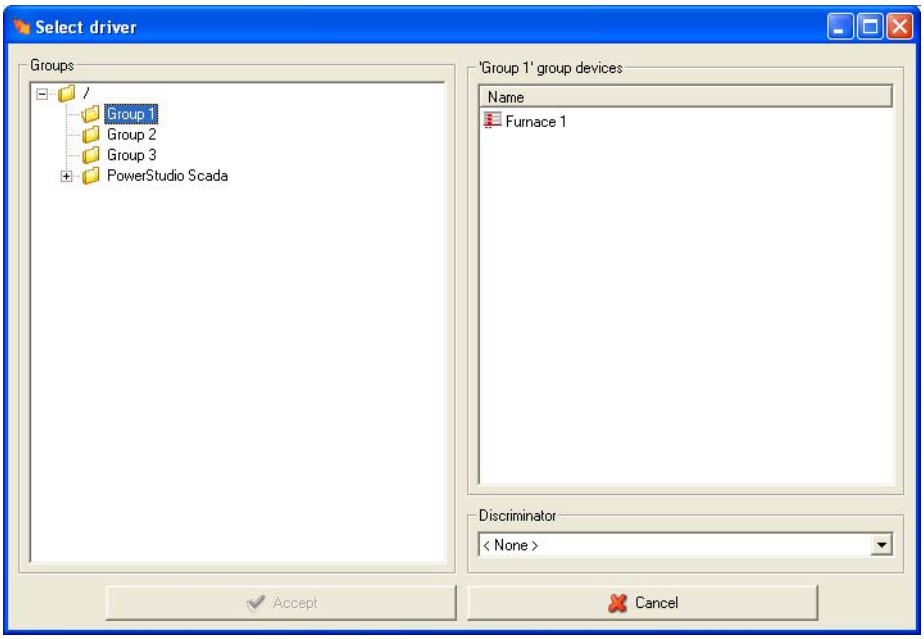


Here we can select what we wish to add to the expression. The option will be added in the position of the cursor in the text control associated to the expression. The lower part of the dialogue shows where we will enter what we want to add:

- [Vx]. If we want to add a reference to a variable of a unit
- Fx. If we want to add a reference to another already defined formula
- F (x). If we want to add one of the functions provided
- x. If we want to add other symbols.

The wizard options are as follows:

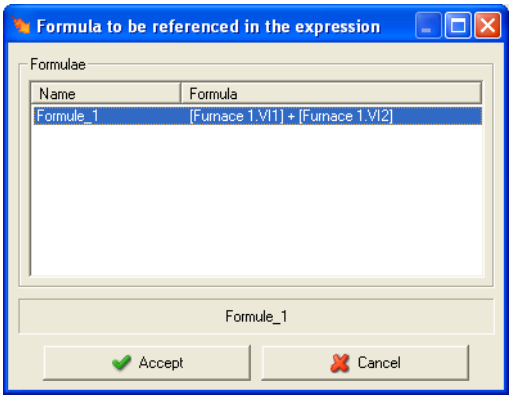
- *Add a reference to a variable of a device:* Selecting this option will display a window where we can choose the device from which one of its variables will be added to the formula.



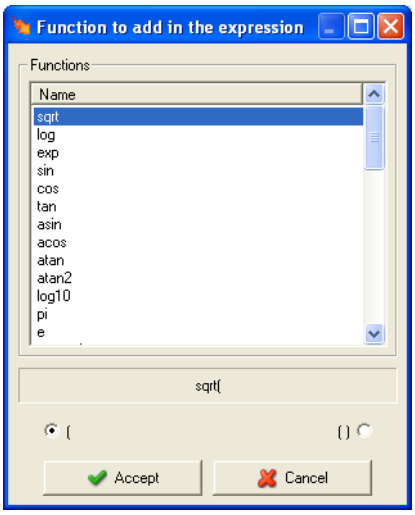
Likewise, we will have the option of specifying a previously defined specific discriminator (see chapter 7) by way of the selection using the control:

Once we have chosen the unit and the discriminator (where appropriate) the variables selection window will be displayed allowing us to pick the variable to be entered in the formula (see 4 Selection of variables).

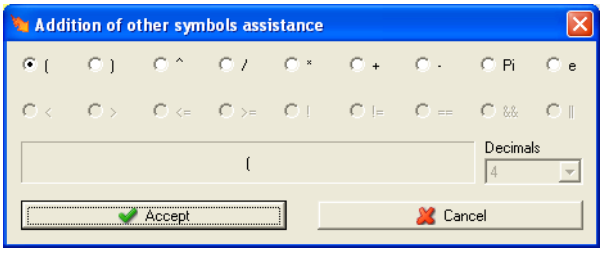
- *Add a reference to an already defined formula:* This option enables us to enter a reference to another previously defined formula. This option is only available in reports and SCADA screens. Selecting this option will display a window where a previously defined formula can be selected:



- *Add one of the functions provided:* This option allows us to access a list of typical mathematical functions which can be entered into the formula being edited:



- *Add other symbols:* this option allows us to enter symbols such as comparators, logical functions, basic symbols, specific mathematical numbers, and so on.



Depending on whether what we are creating corresponds to an expression or a condition, some of these symbols will be disabled and therefore may not be selected.

14.3 XML Services

PowerStudio provides a range of XML services to enable, in some respects, communication with other applications.

In petitions where it is necessary to express a date and time, both in service petitions and the data from the response, these will be represented in UTC (Universal Coordinated Time) with the format DDMMAAAAHHMMSS (two digits for the day, two for the month, four for the year and two for the hour, minutes and seconds. It will also be possible represent only a date as DDMMAAAA assuming that the time is 00:00:00, or represent an hour as HHMMSS. Finally in cases where milliseconds are required these are represented with three digits after the seconds, DDMMAAAAHHMMSSUUU or HHMMSSUUU.

The petitions must follow the URI standard (RFC 2396) so that the user of these petitions has to take into account this detail when making such calls (especially in cases where the name of any device contains non-ASCII characters).

14.3.1 / services / user / devices.xml

Returns the list of configured devices.

```
<devices>
        <id> … </id>
        …
</devices>
```

Where:

- ***devices:*** Main field which will identify the main XML as a response to the device list request.
- ***id:*** Name of each one of the devices.
-

14.3.2 /services/user/deviceInfo.xml?id=device?...

Returns information on devices. Each of the devices on which information is required must be included in the petition as:

?id = device2? id = device2

```
<devices>
        <device>
                <id> … </id>
                <description>… </ description>
                <type>… </ type>
                <typeDescription>… </ typeDescription>
                <var>… </ var>
                …
        </device>
        …
</devices>
```

Where:

- ***devices:*** Main Field which identified the XML as a response to the information request from the devices.
- ***device:*** Information from each of the devices requested:
  - ***id:*** Name of the device.
  - ***description:*** Description of device
  - ***type:*** Type of device (for example CVM144)
  - ***typeDescription:*** A description of the type of device (for example: CVM-144)
  - ***var:*** Name of each of the variables of the device. The name is expressed as device.variable (see 14.1 Variables)

14.3.3 / services / user / varInfo.xml? var = device.variable ?...? id = device? ...

Returns variable information when carrying out the XML request. Each of the variables that the value is required from should be included in the petition as:

?var = device.variable

And if you want to get information from all the variables of a device this must be indicated as

?id=device

With it being possible to request information from one or more variables and one or more devices in the same request.

```
<varInfo>
        <var>
                <id> … </id>
                <title>… </ title>
                <hasValue> T </ hasValue>
                <hasLogger> T </ hasLogger>
                <sampleMode>… </ sampleMode>
                <measureUnits>… </ measureUnits>
                <unitsFactor>… </ unitsFactor>
                <decimals>… </ decimals>
        </ var>
        …
<varInfo>
```

Where:

- ***varInfo:*** Main field which identifies the XML as a response to the request for information about variables
- ***var:*** Information from each of the variables requested:
  - ***id:*** Variable name in device.variable format (see 14.1 Variables)
  - ***title:*** Brief description of the variable.
  - ***hasValue:*** Indicates if it is possible to ask the instantaneous value of the variable (T) or not (F).
  - ***hasLogger:*** Indicates whether it is possible to ask the log value of the variable (T) or not (F).
  - ***sampleMode:*** Variable type, mode used to group together the values of a variable:
    - *none:* Without type
    - *average:* Average value:
    - *max:* Maximum value.
    - *min:* Maximum value.
    - *pfAverage:* Power factor, average value
    - *pfMax:* Power factor, maximum value
    - *pfMin:* Power factor, minimum value
    - *last:* Last value:
    - *earth leakage:* Earth leakage value between the current value and the previous one.
    - *samples:* samples. The value can not be grouped
    - *discrete:* Discreet values. The value can not be grouped
  - ***measureUnits:*** Variable units:
    - #NONE → without units
    - #V → Voltage
    - #A → Current
    - #VA → Apparent power
    - #W → Active power
    - #VARL → Inductive power
    - #VARC → Capacitive power
    - #PF → Power factor

- #HZ → Frequency
- #PERCENT → Percentage
- #WH → Active energy
- #VARLH → Inductive energy
- #VARCH → Capacitive energy
- #DATETIME → Date and time
- If not preceded by an # this is a unit defined by the user

- ***unitsFactor:*** Power of 10 that indicates the value the variable is multiplied by in the log file.
- ***decimals:*** Decimals with this variable.
-

14.3.4 / services / user / values.xml? var = device.variable ?...? id = device? ...

Returns the instantaneous value of the variable when the XML request is carried out. Each of the variables that the value is required from should be included in the petition as:

?var = device.variable

If you want to ascertain the value of all the variables of a device it should be indicated as:

?id=device

With it being possible in a single request to request the value of one or more variables and values of one or more devices

```
<values>
        <variable>
                <id> … </id>
                <value>… </ value>
        </ variable>
        …
</values>
```

Where:

- ***Values:*** Main field which will identify the XML as a response to the request for variable values
- ***variable:*** List of variables:
  - ***id:*** Identifier of the variable in the format device.variable (see 14.1 Variables)
  - ***value:*** Value of variable at the time of the request.

14.3.5 / services / user / forceVariables.xml? id = device

With this petition we may send the order to force variables to PowerStudio. The request must include the name of the device we want to force so that, if necessary, authentication can be checked (see 2.2.12.2 User identification). Only the variables belonging to the device indicated in the petition will be forced.

```
<forceVariables>
        <forceVar>
                <forceName>… </ forceName>
                <forceValue>… </ forceValue>
        </ forceVar>
        …
</forceVariables>
```

Where:

- ***forceVariables:*** Main field that will identify the XML as a petition to force variables.
- ***forceVar:*** Information on each of the variables to be forced:
  - ***forceName:*** Name of variable with format device.variable (14.1 Variables). Only variables that can be forced , for example digital output variables.
  - ***forceValue:*** Value to which we wish to force the variable.
  -

14.3.6 / services / user / records.xml? begin =…? end =…? var =…? period = 900

Returns information on one or more variables between the dates *"begin"* and *"end"*. Each of the variables for which information is to be obtained must be included in the request as:

?var = device.variable

The format of *"begin"* and *"end"* will be DDMMAAAA when you wish only to indicate the date (in this case the hour will 00:00:00) or DDMMAAAAHHMMSS when both the date and the hour are specified. Both "begin" as "end" must be expressed in UTC (Universal Coordinated Time).

Finally, we may specify the period of data grouping using the "*period"* parameter. This value may be:

FILE → data not grouped, returning the register as they have saved in the log.
AUTO →Grouping will take place automatically depending on the specified dates *"begin"* and "end"
ALL →Data is grouped into a single value
> 0 →Value in seconds in which the data is grouped.

If the "*period"* parameter does not appear on the petition it shall be considered as value 0 and the data will not be grouped.

```
<recordGroup>
        <period>… </ period>
        <record>
                <dateTime>… </ datetime>
                <field>… </ field>
                <fieldComplex>… </ fieldComplex>
                <fieldARM>… </ fieldARM>
                <fieldFO> … </fieldFO>
                <fieldEVQ>… </ fieldEVQ>
                …
        </record>
        …
</recordGroup>
```

Where:

- ***recordGroup:*** Main field which will identify the XML as a response to the variable register request.
- ***period:*** Register period. Will report on time elapsed between records.
- ***record:*** Will Identify each of the records:
  - ***dateTime:*** Date and time of the sample.
  - ***field:*** Standard value register.
  - ***fieldComplex:*** Complex value register
  - ***fieldARM:*** Harmonic value register
  - ***fieldFO:*** Waveform value register
  - ***fieldEVQ:*** EVQ event register

Here are the different types of values that can be returned by this request:

- Standard value registers (voltages, currents, power, energy, etc.).

```
<field>
        <id> … </id>
        <value>… </ value>
</ Field>
```

  - ***id:*** Variable identifier (device.variable)
  - ***value:*** Value

- Complex value register (PLT, etc.).

```
<fieldComplex>
        <id> … </id>
        <value>… </ value>
        <flags>… </ flags>
</ fieldComplex>
```

  - ***id:*** Variable identifier (device.variable)
  - ***value:*** Value
  - ***Flags:*** Additional information from the variable formed by the union of one or more of the following values
    - 0x0000 → The PLT is correct
    - 0x0001 →The PLT calculation has been done with fewer samples than expected
    - 0x0002 → The PLT calculation has been done with more samples than expected
    - 0x0004 →The samples used in the PLT calculation do not have an equidistant separation in the sampling window
    - 0x0008 →Some PST used in the calculation of the PLT contain events in phase 1
    - 0x0010 →Some PST used in the calculation of the PLT contain events in phase 2
    - 0x0020 → Some PST used in the calculation of the PLT contain events in phase 3
    - 0x0040 → Some PST used in the calculation of the PLT are not complete

- Harmonic value record

```
<fieldARM>
        <id> … </id>
        <element>
                <harmonic>… </ harmonic>
                <value>… </ value>
        </ element>
        …
</fieldARM>
```

- ***id:*** Variable identifier (device.variable)
- ***Element:*** Registers from each of the harmonics
  - ***harmonic:*** Harmonics number
  - ***value:*** Harmonic value.

- Waveform value record

```
<fieldFO>
        <id> … </id>
        <element>
                <msec>… </ msec>
                <value>… </ value>
        </ element>
        …
</fieldFO>
```

- ***id:*** Variable identifier (device.variable)
- ***Element:*** Information from each of the points that make up the waveform
  - ***msec:*** millisecond
  - ***value:*** value

- EVQ event Record.

```
<fieldEVQ>
        <id> … </id>
        <value>… </ value>
        <phase>… </ phase>
        <duration>… </ duration>
        <averageValue>… </ averageValue>
        <previousValue>… </ previousValue>
        <eventType>… </ eventType>
        <endForced>… </ endForced>
        <semicycleVoltage>
                <date>… </ date>
                <value>… </ value>
        </ semicycleVoltage>
        …
</fieldEVQ>
```

- ***id:*** Variable identifier (device.variable)
- ***value:*** Value of the event:
- ***Phase:*** Phase in which the event occurs
- ***duration:*** Duration of the event in milliseconds
- ***averageValue:*** Average value:
- ***previousValue:*** Old value
- ***eventType:*** Type of event
  - *0 →Interruption*
  - 1 →gap
  - 3 →Overvoltage
- ***endForced:*** Mark if the event has finished correctly (F) or has be forced to finalise (T)
- ***semicycleVoltage:*** Each of the points that make up the semi-circular effective voltage associated with the event. This field is optional and may not exist.
  - *date:* Date and time (DDMMAAAAHHMMSSUUU)
  - *value:* Value

14.4 F.A.Q

14.4.1 None of the equipment communicates. What is happening?

Make sure your computer is switched on and in a mode which can communicate, ensuring particularly that it is not in the set up or starting up mode. Make sure your computer is connected to a PC or a compatible converter and that the wiring is correct. Make sure there is no possibility of any interference in the cable run from the device to the PC or between the device and the converter. If you are connected to a converter, check that the latter is properly connected to the PC. Verify that the grid is not overloaded with an excessive amount of devices. If your computer is connected by way of a 232-485 converter make sure that the switches are in the correct position. Make sure that the equipment bus does not have devices that communicate at different speeds or have the same device number. Check that the PC port is working properly.

14.4.2 A TCP2RS converter does not communicate. What is happening?

Make sure your computer is switched on and connected to the communications network. Make sure there is no possibility of any interference in the cable run from the converter to the PC. Make sure your PC is correctly connected to the communications network and can communicate with other equipment connected to the network (for example with another PC). If you are using a router, make sure the communication port is redirected in the router, to the converter address.

14.4.3 I can not see the applet. What is happening?

Check that the local computer has the Microsoft Internet Explorer, Netscape (Mozilla) or Firefox browser installed. Ensure that the Java Virtual Machine JRE 1.6 (6.0) or later is installed. If they are not installed the browser will provide information and guide us through the installation process.

If the applet appears but shows a message warning that it is "unable to communicate with the server" or "unable to retrieve the required information" make sure the program is in running mode and the Web server is enabled.

14.4.4 The Applet does not display the texts properly. What is happening?

It is possible that some fonts applied to the controls when designing a report or a SCADA screen do not exist on the machine on which the applet is downloaded and, in consequence, the font chosen may be markedly different to the original.

14.4.5 The values display is not what I expected. What is happening?

It is possible that a conditional control or a formula refers to a variable of a device which does not communicate or that has not yet been interrogated for the first time. In a SCADA screen, if we are dealing with a condition nothing will appear and if we are dealing with a formula a dash ("-") appears until the value can start. In a report, if there is no data in this period and we cannot assess the condition of a conditional control, nothing will be displayed and if we can not assess the definition the same will occur.

It may occur that when assessing the formula we come across an invalid operation, such as the square root of a negative number or a zero division, in this case a question mark ("?") appears on the SCADA screen and the report will show the definition of the formula. If we are unable to assess the condition of a conditional, nothing will be displayed.

It may not be possible to represent the assessment of the formula of an expression, either because the control configuration that contains it, or because the assessment returned an out of range value. In this case the following character will appear “#”

14.4.6 An event is not behaving as I expected. What is happening?

When an event does not occur when you think it should, or vice versa, check that this condition can be fulfilled and make sure the event is enabled at some time by the calendar and that the condition can be fulfilled during that interval. Verify that the devices involved in assessing the condition of the event communicate and make sure the program is in the run mode. Make sure you have permission to see this type of event and you have checked the notify and / or register box.

If the incident appears not to have carried out actions that have been defined, check what has actually occurred in the list of events. If the event has still not produced the programmed action or actions, check that the equipment upon which it should have acted is on and communicating correctly. Should the action involve the running of an external application, check that the said application is properly installed and that the command and parameters are correct (you can put this action in a run control in a SCADA screen test to see if it behaves as expected)

14.4.7 I can't paint the graph correctly. What is happening?

If the graph appears to have dots missing, verify that this is not because the variables are being represented with different periods.

If the bar charts has widths that are not correct, ensure that the values are separated by the distance marked by the driver period. For example, if a device saves data every 5 minutes and we change the period to 15 minutes, the bars will be superimposed when displaying the bar graphs for the values prior to the change of period (every 5 minutes). If we change the period to a lower value, the bars prior to the change will appear narrower than necessary. In any case, the bar graphs of values separated by the distance shown in the Driver registration period will always appear correctly.

If you do not see any values when you think there should be, ensure that you have not zoomed in an area without values or that the Y-axis is not forcing levels for values which do not exist.

14.4.8 The Paint Pot is not working correctly. What is happening?

If when placing the paint pot control on a SCADA screen, this does not behave in the manner expected ensure that:

1 .- The condition or conditions defined are right for each colour.

2 .- The area in which the control is positioned has a uniform colour. It is possible that the area where the paint pot is positioned has different coloured dots but with very similar tones, which at first sight appear the same. The paint pot control only spreads through identical colours.

3. - The area to be filled with the colours defined in control is not part of another control. The paint pot control only interacts with the screen background and does not take into account any of the other controls. Do not attempt to use the paint pot to fill, for example, an image by way of the image type control.

14.4.9 Can I launch external applications from applet?

For security reasons, Java Applets have some fairly significant limitations with regards accessing the resources of the local machine on which they are running. One of these restrictions is being able to run applications on the local machine. Nevertheless, this restriction may be disabled by adding the following line to the *java.policy* permissions file situated in the installation of the JRE virtual machine:

```
permission java.io.FilePermission "<<ALL FILES>>", "execute";
```

It must be noted, however, that the Applet can not directly display files directly from the run control, in the way SCADA can. So, if we wanted to show an image in applet it is not enough to enter the name of the image in the run control, but rather we should enter the application we want to use to show the image and, as a parameter, the image to show.

Note: The option to launch external applications very much depends on the system in which applet is running, and it is highly probable that it will only work in the system for which the application has been developed.

14.4.10 How can I see the applet from a machine which is not running Windows?

The applet can be viewed without carrying out any other special action from all operating systems that have Java Virtual Machine 1.5 (5.0) or later and an HTML browser. Among others, the following operating systems would satisfy these requirements: Windows, Linux, Solaris SPARC, Solaris x86, Solaris AMD64, Linux AMD64, and so on.

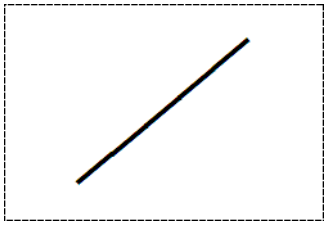
14.4.11 How can I draw a line in a report or a SCADA screen ?

Although there is a specific tool to draw lines, it is possible to carry out this function in two different ways:

1 .- Draw lines you want in the background image beforehand.

2 .- If you want to draw vertical and / or horizontal lines and it is not practical to use the method above, it is possible to carry out this function by way of a simple trick. The procedure involves obtaining a solid rectangle or square image of the colour you like for the line (this may even consist of a simple pixel image). Then add an image control and assign the previous box to it. Disable the fields of "Maintain real size" and "Maintain aspect ratio" and use the control to obtain the desired horizontal line and / or vertical thickness desired.

3 .- Add a text control and write the text "_____" (underscore characters and as long as needed) This creates a horizontal line. This method has the advantage that it allows vertical or diagonal lines to be applied by text rotation (90 or 270 degrees for vertical lines), colour change and it also allows the thickness to be changed by modifying the size.



Diagonal Line

14.4.12 I am making my first screen or report and I cannot add a background image or a still picture. What is happening?

You should remember that the images that can be included on the SCADA screens and the reports must have been added previously through the image manager. Therefore it is necessary before starting to design a screen or report to add the images you will need through the image manager.

14.4.13 What can be "counted"?

Any event added to the system contains a variable that indicates how many times it has been enabled, how many times it has been recognized, how many times it has been deactivated, how long has it been active, if it active at the moment and how long has elapsed since it was last enabled.

The number of times something has occurred during the hour in course, the day in course, and so on, can also be counted To do so create a calculable forcible variable initialized to 0 and an event that when a condition is complied will undertake the action of forcing this variable to the same value plus a unit.

```
[R$CAL_FORCED.COUNTER1]=[R$CAL_FORCED.COUNTER1]+1
```

We then just need to add an event that would reset this counter to 0 when the date was outside XX / XX / XX 00:00:00 (00:00:00 hours each day) with which the counter would have the number activations of the day in course. The counter reset could be carried out with a variable forced control on the SCADA screen, in this case manual instead of automatic.

14.4.14 I would like to export the report data in order to process it later. How can I do it?

The data displayed in a report is log data grouped together for the period of the report, therefore we have a value per period (if it is an expression where several variables are involved the value of each variable is recovered for the period of the report and the expression assessed).

For practical purposes, the values of the variables that are used in the reports can be consulted by petitioning **/ services / user / records.xml** (which is documented in the XML user requests section).

Imagine then we have a report with the following aspects:

C1	C2	C3	C4
45,155	45,187	15,052	11,013
118,731	76,6	74,207	15,41
45,155	45,187	15,052	11,013
118,731	76,6	74,207	15,41
45,155	45,187	15,052	11,013
118,731	76,6	74,207	15,41
45,155	45,187	15,052	11,013
118,731	76,6	74,207	15,41

(*) Values are related to quality N-50160

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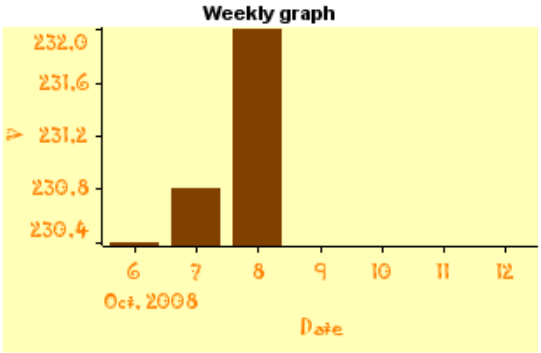
Data related to graph

Data A:	1,325
Data B:	1,335
Data C:	1,334
Data D:	1,334



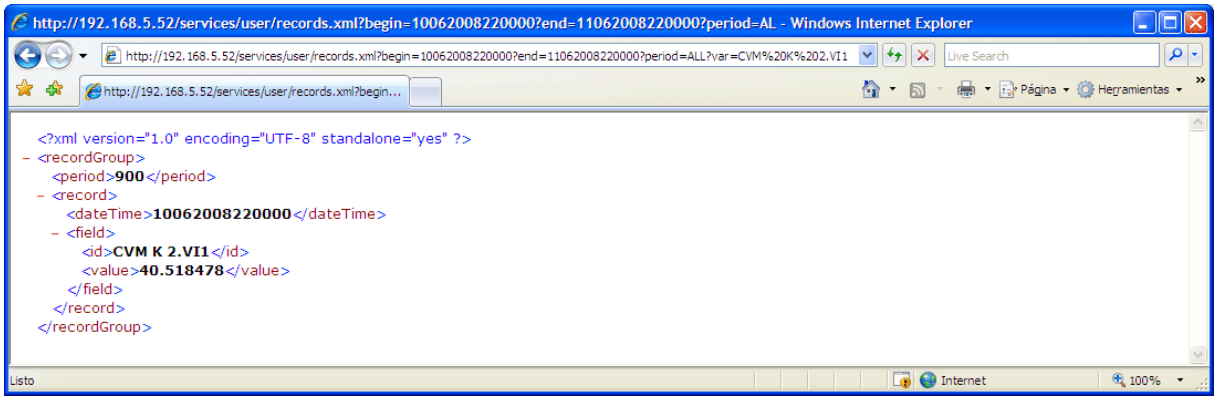
Report generated

The report is grouped by day, in particular, we are viewing October 12th. It shows that there are a number of values in red, inside boxes, the first value on the top left corner corresponds to the variable CVM 2.VI1 K ".

To see that value through a HTTP / XML petition to the server we can do the following:

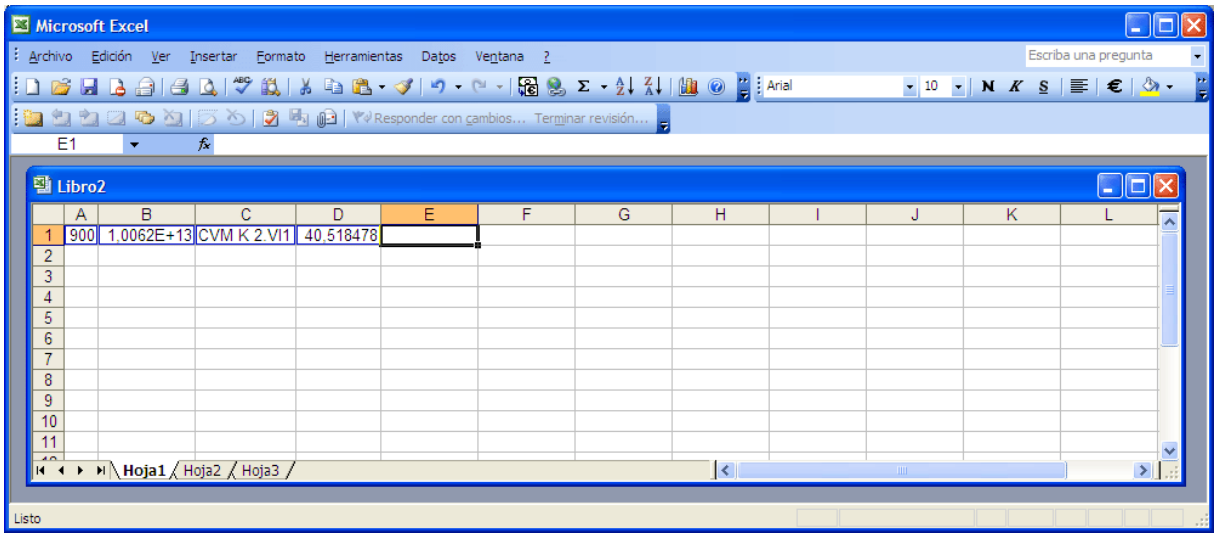
```
http://192.168.5.52/services/user/records.xml?begin=10062008220000?end=11062008220000?period=ALL?var=CVM K 2.VI1
```

This request, if carried out with the browser, will return something similar to the following:



Result of the request from the Internet Explorer browser

Where, in the "*value*" field we have the desired value. This request can be done directly from, say, the Excel spreadsheet, by simply writing this request in the dialogue "Open" (instead of the name of a file). Excel will interpret the previous XML and generate a table with data:



"Open" petition with Excel 2003. In D1 we have the data.

14.4.15 I tried to make a table with the client application and I get the Message "Table too Big." What can I do to see it?

The client is a Java application. As a Java application it runs on a virtual machine with a limited memory for it to run assigned by default. Normally this amount of memory allocated by default is sufficient for running the programme. But perhaps for very large tables this memory is insufficient.

For these cases it is possible to run the client application forcing the virtual machine to assign more memory to the program. This is accomplished by running the program from the command line with a parameter indicating the maximum and minimum memory available for the program.

```
java -Xm256m -Xmx1024m –jar AppletScada.jar
```

As you can see the parameters Xm-and-Xmx allocate a minimum and a maximum quantity to the program.

14.4.16 How can I simulate a control switch?

To simulate the behaviour of a switch (e.g. to act on a digital output) we need a conditional control and two controls to force the variable. The control conditional would contain two images, one with the representation of a switch open, with the condition that the digital variable is 1, and another with the representation of a closed switch, with the condition that the digital variable is 0.

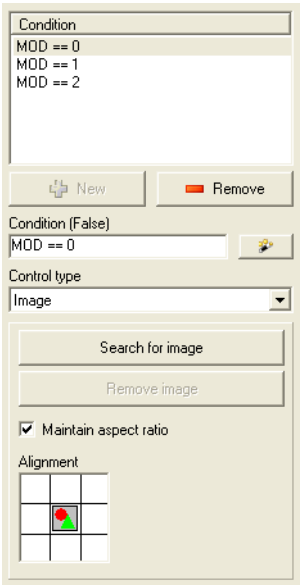
A control is positioned on the left part of the control to force a variable with a digital output value at 1, whilst another control is positioned on the right-hand section to force a variable with the output value at 0.

14.4.17 How do I add animation on the SCADA?

To add a small animated image the conditional control combined with the "***second***" function in the condition is added. First, save the images that make up the animation using the image manager. Suppose your animation consists of a sequence of 3 images. Assume further that we want our animation to change every second. Therefore we will have to create a list of formulae on the SCADA screen which will return module 3 of the "***second***" function (which will vary between the values, 0, 1 and 2). The function is as follows:

```
mod(second,3)
```

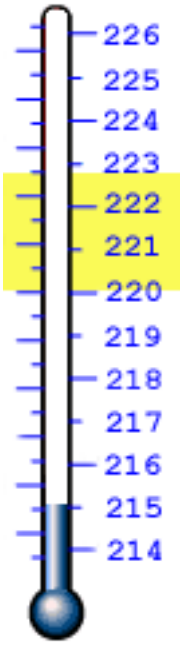
Suppose we call this function MOD. Now we can define a conditional control with 3 conditions, where each condition displays one of the images that form the animation. The following shows control properties:



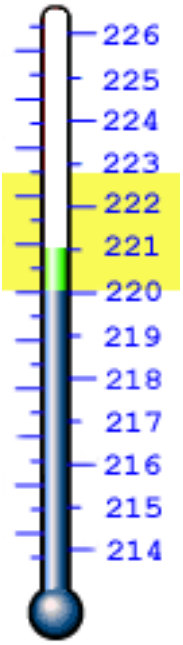
The result is that one of the images that make up the animation is shown every second. As can be seen, there are many combinations to be carried out and a large variety of opportunities to exploit using this technique.

14.4.18 How can I simulate a level control?

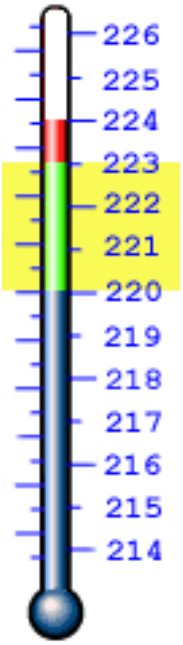
There are two ways to do a level control on a SCADA screen. The first one is to use a conditional control, where each control is an image with a different level and where every condition indicates what should be fulfilled to reach this level. Here are some images showing us specific examples with its conditions:



[CVM K 1.VI1] == 215



[CVM K 1.VI1] == 221



[CVM K 1.VI1] == 224

Another option would be to draw the level control at the bottom of the SCADA screen and use various paint pot controls to paint the desired zone. Thus, we could draw on the screen background something like the following:

The inner part, although it seems all the same colour (white), it is not and is divided into grids with different whites indistinguishable one from the other and by the human eye (for example, it is impossible to distinguish between white RGB 255,255,255 and white RGB 254,255,255) .

Then we place the paint pot on each table with the desired condition and tolerance 0 to prevent painting adjacent tables, which are very similar in colour.

With this, the result is a progress bar (or control level) which can be configured as desired.

14.4.19 How can I change the properties of control in accordance with a condition?

The properties of control cannot be changed in accordance with a condition. However, we can simulate the change of these properties, using a conditional control. Thus, for example, if we wish to change the colour of a text in accordance with a condition we add a conditional control with two text type controls which are exactly the same but of a different colour, and specify which conditions need to be fulfilled for each one to be shown. Likewise, we can also change the orientation, font, size, etc.

We can also make a control be an image or a text in accordance with a condition using, as in the previous case, the conditional control.

14.4.20 How can I know the status of a device?

All devices have a variable called STATUS that shows the status of the device using a numerical value (for example, [CVM144.STATUS]). The meaning of this variable is the same for all devices and can be used in the conditional expressions (see the appendix to check the types of variables and their possible values)

14.4.21 How can I display documents from a SCADA screen?

To show documents previously stored on the PC the run control can be used. If we wish to show a PDF file, we can enter its name directly (including the complete path) in the program field, so that the said file will open in the related, defined programme when running the screen and clicking on the control. Likewise, we can do this with any file type which has an associated programme to open it. (DOC, TXT, HTML, WAV, MP3, MPG, AVI, etc.)

Note: This option will not work on systems which do not run Windows, nor when using the applet.

14.4.22 How can I obtain an event according to the status of a device?

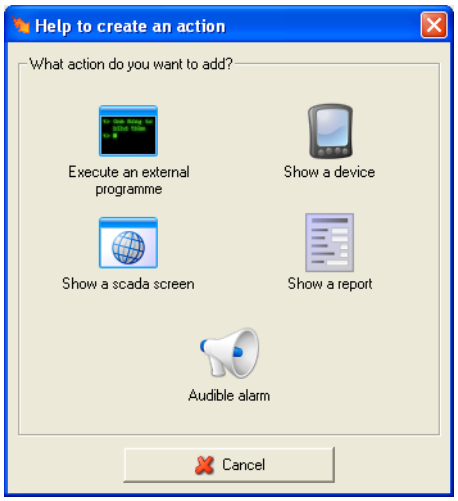
To produce an event according to the status of one or more devices using the STATUS variable of the said devices in the event activation status. The possible values of the STATUS variable can be seen in the variable type appendix.

Since the events generate a number of variables associated to them, we can even see how many times an event was enabled, how many times it was deactivated, how many it was recognized and how long it was enabled.

14.4.23 How can I produce sounds in response to an event?

To produce a sound in response to an event, we should add an action to run an external program and enter the corresponding (WAV, MP3, etc.) with its full path in the programme field. For the action to take effect, you will need to have a program installed that can play back this type of file (for example, Windows Media Player, Sonique, Winamp, etc.).

If what is needed is simply reproducing a bleep on the client application, an action associated with this event can be added to carry it out. Likewise this action can occur during activation, recognition, on deactivation or while active.



Support for the audible alarm action on the client in response to an event

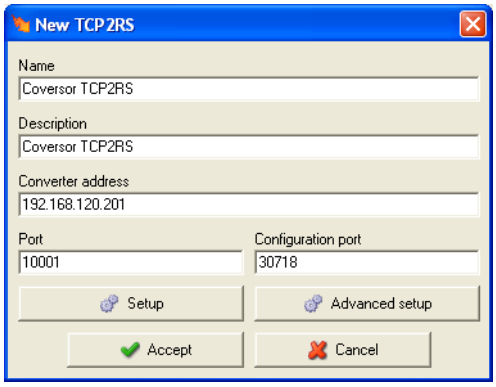
14.4.24 How do I show documents in response to an event?

In a similar manner to the previous point, adding an action to run an external program and entering the file to be shown (PDF, TXT, DOC, etc.) and its corresponding path. For the action to take effect, you will need to have a program installed that can read this type of file (for example, Microsoft Word, Adobe Acrobat Reader, etc.).

14.4.25 How can I communicate with a TCP2RS converter by way of a router?

To communicate with a TCP2RS converter located in a sub-network different to the network in which the software is located, we can use a router as shown in the following image

The TCP2RS converter should be added as follows



1- Enter the router address (192.168.120.201)–In the “Converter Address” field.
2- Redirect the port‘10001 ’and*‘30718’* in the router to the converter address (192.168.15.205) (see router manual)